



DETERMINING THE EFFECT OF COGNITIVE TRAINING IN INDIVIDUALS WITH VESTIBULAR DYSFUNCTION TO OVERCOME THE FEAR OF FALL IN ELDERLY

Physiotherapy

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ABSTRACT

Background of the study: Vestibular dysfunction may lead to atrophy of areas within the cortical vestibular network including the hippocampus, which may in turn be responsible for impairments in memory and visuospatial ability. Increased gaze and postural instability associated with vestibular loss may require increased attentional resources allocated to maintaining balance and decreased resources available for cognitive tasks. The high comorbidity of affective disorders in individuals with vestibular impairment may also contribute to cognitive dysfunction. **Aims and objectives:** To determine the effect of cognitive training in individuals with vestibular dysfunction to overcome the fear of fall in elderly. **Methodology:** After obtaining the clearance from institutional ethical committee, subjects were screened for inclusion and exclusion criteria. Written informed consents were taken from subjects falling under inclusion criteria. Details of the study procedure were explained to the subjects. Baseline assessment of fear of fall was done using Activities Specific Balance Confidence scale (ABC). The subjects who scored < 80% on ABC scale were assessed for vestibular dysfunction using DGI scale. The subjects who scored < 12 on DGI scale were categorized under subjects with vestibular dysfunction. Cognitive behavioural therapy was used as an intervention for subjects with vestibular dysfunction following which ABC scale was reintroduced to check the change in fear of fall. **Results:** The data was analyzed using statistical software SPSS 16. Paired t test was used to check the change in balance score following cognitive training. There was improvement in balance score with mean change of 23.41±8.8 which was found to be statistically significant. **Conclusion:** The cognitive behavioural therapy was proved to be effective in improving fear of fall in elderly population with vestibular dysfunction according to the Activities Specific Balance Confidence scale (ABC).

KEYWORDS

Fear of fall, vestibular dysfunction, and cognitive behavioral therapy.

INTRODUCTION

Fear of falling is an internal phenomenon or anxiety associated usually with falling that can impact significantly on purposeful activity and independence, and lead to deconditioning to the point of loss of function.

Falling represents a significant threat to independence and quality of life in terms of function, morbidity/mortality. Falling is amongst the common causes of injury affecting older people in both residential care and home settings but only ten percent cause serious injury. Prevalence rates vary but there is some consensus that falls affect between twenty to thirty percent of people over 60 years of age. Although, interestingly one study has also found falls affected thirteen percent of people in the 40-59 year age group. Females experience a greater number of falls (a ratio of 3:1) compared with falls experienced by males.¹

The vestibular system, which contributes to balance and sense of spatial orientation, is the sensory system that provides the leading contribution about movement and sense of balance. The peripheral and central vestibular systems exhibit an age related structural deterioration which may be responsible for vestibular reflex deficits and dizziness in the elderly. However, it seems likely that the central nervous system is capable for compensating for certain degree of decline in function, since not all elderly are impaired to the extent that the clinical signs of vestibular dysfunction are apparent. Dizziness and other vestibular disorders may develop only after degree of deterioration exceeds the ability of the nervous system to compensate.²

Vestibular dysfunction may lead to atrophy of areas within the cortical vestibular network including the hippocampus, which may in turn be responsible for impairments in memory and visuospatial ability. This system may be compromised in patients with vestibular disorders, in turn affecting the individual's attention system. Increased gaze and postural instability associated with vestibular loss may require increased attentional resources allocated to maintaining balance and decreased resources available for cognitive tasks. The high comorbidity of affective disorders in individuals with vestibular impairment may also contribute to cognitive dysfunction. Cognitive deficits seen in vestibular patients are likely due to the lack of vestibular input (visuospatial ability- tracking, spatial mental representation) and attention.³

Cognitive and behavioral interventions are the most widely studied psychological interventions for addressing the information processing biases and avoidance behaviors that are characteristic of the anxiety disorders. Cognitive behavioral therapy (CBT) is a collaborative, structured, skill-building, time-limited, and goal-oriented intervention designed to target core components of a given disorder. Numerous randomized controlled trials have shown that CBT is effective in reducing symptoms of psychopathology, and stronger effects are often reported for the treatment of anxiety disorders relative to other conditions.⁴

Cognitive function can be classified into various domains which includes visuospatial ability, memory, executive function and attention.^{6,10,14} It has been known that altered or absent vestibular input may lead to fundamental change in an individual's mental representation also patients with vestibular deficits has impairment in spatial navigation abilities. The vestibular system has been shown to activate broad cortical network including insula, superior temporal gyrus, hippocampus and inferior parietal lobule which are part of complex neural network for visuospatial processing and memory. Vestibular dysfunction may lead to atrophy of the areas within cortical vestibular network.³

So we hypothesize that improvement in cognitive function may lead to reduction in balance issues due to vestibular dysfunction. Hence, the present study aimed to see the effect of cognitive training on balance issues in patients with vestibular dysfunction.

Method

After obtaining ethical clearance from institutional ethical committee, subjects were screened for inclusion and exclusion criteria. Subjects who were in the age group of 60-80 years with primary level education were selected based on purposive sampling. Subjects with history of any neurological disorder, uncorrected visual and auditory impairment, any diagnosed significant psychiatric ailment such as mood disorder i.e., depression or anxiety, significant musculoskeletal disorder influencing DGI and any medical condition or systemic disease interfering application of tool for data collection were excluded from study.

Old age home and various community recreation and gathering centers were used for data collection. After taking permission from concerned authority, 60 subjects were screened out of which 30 were selected.

Written informed consent was taken from subjects falling under inclusion criteria. Details of the study procedure were explained to the subjects. Baseline assessment of fear of fall was done using ABC scale. The subjects who scored < 80% on ABC scale were assessed for vestibular dysfunction using DGI scale. The subjects who scored < 12 on DGI scale were categorized as vestibular dysfunction. Cognitive behavioral therapy was used as an intervention for the subjects with vestibular dysfunction which was given thrice a week for one month incorporating 12 sessions each lasting for ten minutes.

Cognitive Behavioural Therapy

This included arousal reduction technique such as diaphragmatic breathing exercise (5 minutes).⁸

The subject was prepared in a relaxed and comfortable position in which gravity assisted the diaphragm, such as a semi-fowler's position. If the examination revealed that the subject initiated the breathing pattern with the accessory muscles of inspiration (shoulder and neck musculature), instruction was started by teaching the patient how to relax those muscles. The therapist's hands were placed on the subject's rectus abdominis just below the anterior costal margin. The subject was asked to breathe in slowly and deeply through the nose. The subject was asked to keep the shoulders relaxed and upper chest quiet, allowing the abdomen to rise slightly. Then the subject was told to relax and exhale slowly through the mouth. The subject was asked to do this three or four times and then rest. The subject was not allowed to hyperventilate. If the subject was having difficulty using the diaphragm during inspiration, then he/she were asked to inhale several times in succession through the nose by using a sniffing action.⁹

Exposure based protocol (5 minutes) -The subject was asked to move on level surface of length 6 metre at his normal speed. The subject was asked to start walking when the clapping was done once and to stop when the clapping was done twice each time. Then the subject was asked to alter the walking speed and then walk. Here the subject was asked to walk at fast speed when the bell was rung once and to walk at slower speed when the bell was rung twice. After this the subject was asked to move with horizontal and vertical head turns. The subject was asked to turn the head in right direction on the sound of the whistle and walk. Again the subject was asked to turn the head in left direction when the whistle was played twice and then walk. In the same way the subject was asked to walk by turning the head vertically up on the sound of the whistle and to walk by turning the head vertically down when the whistle was played twice.

RESULT

The data was analyzed using statistical software SPSS 16. Descriptive statistics was used to summarize the variable. Paired t-test was used to see the change in score of ABC scale.

The mean ABC scores, before intervention was 62.76 ± 12.11 . Following intervention, the mean ABC score changed to 86.17 ± 3.29 (mean $\pm$ SD). The observed change in ABC score over a period was highly significant ($p \leq 0.01$).

As seen in table 1, there was significant difference in the ABC score between the groups ($p \leq 0.01$).

Table 1: Showing mean change in ABC (fear of fall) score following cognitive training

ABC	Mean $\pm$ SD	p value
ABC pre	62.76 ± 12.11	$p < 0.01$
ABC post	86.17 ± 3.29	

As seen from the table, the mean difference between pre and post values of ABC (fear of fall) in subjects with vestibular dysfunction was 23.41 with standard deviation of 8.82. This shows that cognitive behavioral therapy was effective in reducing fear of fall among subjects with vestibular dysfunction.

DISCUSSION

This study was designed to check the effect of cognitive behavioural therapy in individuals with vestibular dysfunction on fear of fall in elderly.

This study was conducted on 30 subjects with vestibular dysfunction. The mean age of the subjects with vestibular dysfunction was 67.93 ± 5.23 years. These subjects were found to suffer from fear of fall with

average ABC score^{62.76}

The mean $\pm$ SD difference between pre and post values of ABC (fear of fall) among participants was 23.41 ± 8.82 which showed that the intervention was effective for the improvement in fear of fall. The change in score was highly significant statistically (p value ≤ 0.01).

According to Douglas A. Hanes and Gin McCollum (2005) from a physiological perspective, the existence of cognitive- vestibular interactions is supported by the existence of neuronal projections between the vestibular centres in the brainstem and the cerebral cortex. It is well established that the vestibular system is critical in the execution of spatial navigation and spatial memory tasks, both of which certainly have a cognitive/ cortical component. This deficit can perhaps be explained in terms of a cortical representation of external space and the body's movement through it: deficits in the vestibular sensory system detract from the ability to accurately update this representation.¹⁰

Cognitive behavioural therapy (CBT) improves specific cognitive processes, such as attention, memory and executive skills. Best-practice principles used in CBT towards fall prevention includes problem solving towards activity avoidance, unsafe behaviour, and unsafe environment.

Preliminary evidence is presented which suggests that cognitive activity play a significant role in basic orientation, perception and balance control.¹¹

Damage to the vestibular organ initially provokes disorientation, postural instability, and autonomic symptoms. It is clear that compensation is a form of (re)learning, and must therefore be influenced by psychological factors such as anxiety, arousal, attention, and motivation. Moreover, there are many intriguing parallels between 'vestibular rehabilitation' and cognitive behavioral therapy for panic disorder.

It is clear that recovery from balance disorder is a process of habituation and relearning that involves many different structures, mechanisms, and activities. These may include central neurophysiological adaptation, desensitization to dizziness sensations, the recovery of automaticity in the perception and control of orientation, and the development of conscious strategies and coping skills. Consequently, it is apparent that the course of recovery from balance disorder can be profoundly influenced by psychological factors, such as cognitive, emotional,

and behavioral responses.¹² These all explain the results within the groups which was highly significant (p value ≤ 0.01) according to statistics.

CONCLUSION

Present study concluded to state that the cognitive behavioural therapy proved to be effective in improving fear of fall in elderly population with vestibular dysfunction according to the Activities Specific Balance Confidence scale (ABC). This study provides therapeutics and ideas to focus on cognition as a new intervention programme for improving fear of fall in the elderly population. Also the already defined interactions between cognitive and vestibular system can be incorporated as a part of treatment regime.

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