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Post-stroke Depression and Its Relationship with Balance Impairment and Mobility in Patients with Chronic Stroke Hemiparesis – A Correlational Study

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Abstract

Background: Stroke is defined as the immediate loss of neurological function caused by an interruption of the blood supply to the brain or because of the bursting of blood vessels in the brain. A major problem that has been encountered and recorded by clinicians after a stroke attack is depression, which has been found out in almost 33% of patients, and is termed as post-stroke depression (PSD). The balance in gait impairment in stroke patients affects the functional mobility leading to a reduction in psychological health. This not only affects functional independence but also has been shown to decrease the graph of rehabilitation progress. The objective of the study is to identify the relationship between the gait and balance deficits in chronic stroke patients with depression.

Methodology: Thirty chronic stroke patients who fulfilled the study criteria participated in the study. The demographic details of the patients were recorded. The gait and balance capabilities of the patients were assessed using Dynamic Gait Index (DGI) and Berg Balance Index (BBS) respectively. The depression levels of the patients were assessed using Beck Depression Inventory (BDI).

Results: The statistical analysis found a significant negative correlation between BDI and DGI (r= -0.850, p<0.001) and between BDI and BBS values (r= -0.904, p,0.001).

Conclusion: The study concluded that the depression levels are lower in chronic stroke patients with better gait and balance capabilities.

Keywords: Stroke; Depression; Balance; Gait; Mobility

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Introduction

Stroke is pathologically defined as the acute loss of neurological function resulting from either an interruption of blood supply (ischemic stroke) or hemorrhage within the brain parenchyma [1]. It is consistently ranked as the third leading cause of death globally and a major contributor to long-term disability among adults [2]. The resulting motor deficits, particularly hemiparesis, often lead to chronic disability, significant activity limitations, and participation restrictions for survivors and their families [3].

Beyond the immediate physical deficits, depression is a prevalent psychological sequelae experienced by stroke survivors, affecting approximately 33% of patients and termed as post-stroke depression (PSD) [4]. PSD significantly diminishes a patient's quality of life and is considered the strongest predictor of poor functional recovery and increased future mortality risk [5].

A common and critical physical limitation affecting functional independence is balance impairment. Balance, defined as the control of posture, is essential for functional mobility [7]. Around 83% of stroke survivors exhibit static and dynamic balance issues, which severely impact walking function [6]. Deficits in complex balance activities are the strongest predictor for falls in community-dwelling post-stroke individuals, leading to a fear of falling, activity aversion, and a sedentary lifestyle [8]. This imbalance not only affects functional independence but also impedes rehabilitation progress [9]. Given the intertwined nature of physical limitations and psychological health, the relationship between balance, mobility, and depression warrants close investigation.

The objective of this correlational study is to identify the nature and strength of the relationship between balance and gait deficits and the presence and severity of depression in patients with chronic stroke hemiparesis. Understanding this relationship will provide a clinical finding that may be used to modify and incorporate psychological considerations into standard physical rehabilitation treatment protocols.

Methodology

Study Design and Setting

This study utilized a correlational design. The research was conducted across multiple physiotherapy and rehabilitation settings in Guwahati, Assam, including the Out-Patient Clinic of the College of Physiotherapy & Medical Sciences, the Physiotherapy Department of Guwahati Medical College, and the Amber Rehabilitation Center. The total duration of the study was two months.

Participants

A sample size of 30 patients with chronic stroke hemiparesis was recruited using a non-probability convenience sampling technique, enrolling patients who were available and met the inclusion criteria during the study period.

Inclusion Criteria

- Patients who had a single stroke event (ischemic or hemorrhagic cause).
- Stroke duration of six months or more with persistent symptoms of gait and balance deficits.
- Patients between 41 and 75 years of age.
- Patients who were able to walk a minimum of 10 meters with or without a walking aid.
- Patients of any gender and side of the body affected.

Exclusion Criteria

- Patients who had experienced more than one episode of stroke.
- Patients with significant cognitive deficits (Mini-Mental State Examination score < 24/30), receptive aphasia, or apraxia.
- Patients who were not medically stable at the time of the study.
- Patients with other concomitant neurological or orthopedic conditions causing disability.
- Patients already receiving medical management for depression or other psychological illnesses.

Ethical Considerations

Ethical clearance was obtained from the institutional ethics committee of the College of Physiotherapy and Medical Sciences, Guwahati, in accordance with the ethical guidelines for biomedical research on human subjects.

Outcome Measures

Three standardized, reliable, and validated outcome measures were used to assess the variables:

1. Beck Depression Inventory–II (BDI-II): This is a 21-item self-report measure used to quantify the severity of major depression symptoms. The total score indicates the level of depression: Minimal (0-13), Mild (14-19), Moderate (20-29), and Severe (30-63).
2. Berg Balance Scale (BBS): A 14-item objective measure designed to determine a patient's ability to safely maintain balance during a series of tasks. Each item is scored on a five-point ordinal scale (0-4), yielding a maximum score of 56. A score < 45 is predictive of a greater risk of falling.
3. Dynamic Gait Index (DGI): The DGI is a clinical tool used to assess gait, balance, and fall risk, specifically evaluating the individual's ability to modify balance while walking in the presence of external demands. It consists of eight items scored on a four-point ordinal scale (0-3), totalling a maximum score of 24. A score < 19/24 is predictive of falls in the elderly.

Statistical Analysis

Data analysis was performed manually. Descriptive statistics (Mean, Median, and Standard Deviation) were used to summarize the demographic and clinical characteristics of the sample. To identify the relationship between depression and physical impairment, Pearson Correlation Analysis was employed to assess the correlation between:

1. BDI-II scores and BBS scores.
2. BDI-II scores and DGI scores.

The level of significance for all tests was set a priori at $p < 0.05$.

Results

The data analysis and statistical results demonstrate a clear relationship between depression levels and the functional mobility and balance capabilities of the study participants.

Study Population Demographics

A total of 30 chronic stroke patients were recruited for the study. The mean age of the population was 58.80±7.03 years. The cohort was predominantly male, consisting of 23 males (77%) and 7 females (23%). The mean duration of stroke was 9.50±3.41 years. Regarding the affected side, 14 patients (46.6%) had right-side involvement, and 16 patients (53.3%) had left-side involvement.

Outcome Measures Findings

The study utilized the Beck Depression Inventory (BDI), Dynamic Gait Index (DGI), and Berg Balance Scale (BBS) as outcome measures.

- Beck Depression Inventory (BDI): The mean score was 20.73±10.16. Scores ranged from a minimum of 4 to a maximum of 42. Frequency analysis showed that the majority of the study population (n=12) fell into the moderate depression category.
- Dynamic Gait Index (DGI): The mean score was 15.00±5.45. Scores ranged from 1 to 21. The majority of the study population (n=19) had scores that indicated an increased prediction for falls.
- Berg Balance Scale (BBS): The mean score was 38.97±11.31. Scores ranged from 10 to 53. The frequency distribution indicated that the majority of the patients (n=15) were categorized as having a low falls risk.

Correlation Analysis

Pearson Correlation was performed to analyze the relationship

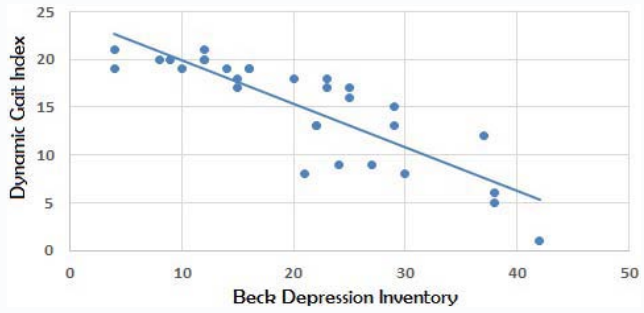


Figure 1: Scatter plot depicting negative correlation between BDI V/S DGI.

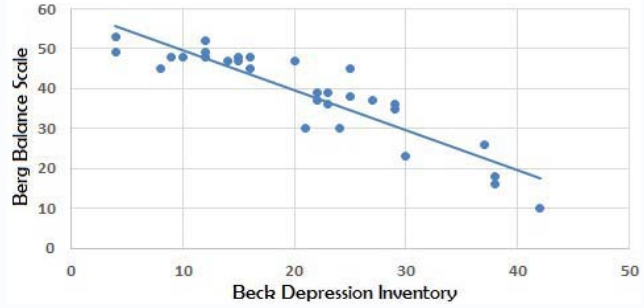


Figure 2: Scatter plot depicting negative correlation between BDI V/S BBS.

between the depression scores (BDI) and the measures of ambulatory and balance capabilities (DGI and BBS).

A strong, statistically significant negative correlation was found between the depression scores (BDI) and both the DGI and BBS scores.

- BDI and DGI: A strong negative correlation was observed with a Pearson correlation coefficient (r) of −0.850 ($p<0.001$) (Figure 1).
- BDI and BBS: An even stronger negative correlation was observed with a Pearson correlation coefficient (r) of −0.904 ($p<0.001$) (Figure 2).

These findings demonstrate a strong inverse relationship, suggesting that chronic stroke patients with better ambulatory and balance capabilities (higher DGI and BBS scores) have significantly lower depression levels as measured by the BDI.

Discussion

The current study investigated the relationship between post-stroke depression (PSD) and physical function, specifically balance and mobility, in patients with chronic stroke hemiparesis. The core finding was a strong, significant negative correlation between depression severity (BDI-II) and both balance (BBS) and mobility (DGI), which substantiates the clinical observation that the physical and psychological outcomes of stroke are deeply interconnected. This suggests a significantly better psychological health profile in individuals who maintain superior physical capabilities.

The observed negative correlation implies that as balance and gait capabilities increase, the levels of depressive symptoms decrease. This relationship can be attributed to several interacting factors. Functionally independent patients experience increased confidence and reduced dependency on caregivers in their daily activities. The ability to perform self-care and ambulate safely, even with minor assistance, minimizes the fear of falling breaks the vicious cycle of fear-avoidance, sedentary lifestyle, and increasing dependency. Furthermore, the decreased caregiver burden associated with patient independence may indirectly contribute to a more positive home environment, fostering a sense of self-efficacy and reduced depression.

These results align conceptually with previous literature. Algwhire et al. [8], for instance, concluded that increased physical abilities were associated with decreased depressive symptoms, suggesting that an active lifestyle post-stroke can mitigate the risk of depression. Conversely, the findings slightly contrast with those of Abarogu et al. [9], who, despite finding that poor dynamic balance *may* affect depression, did not identify a statistically significant association. The present study's significant findings highlight the profound impact that quantifiable, functional mobility measures (BBS and DGI) have on the self-reported psychological state in the chronic phase of stroke.

In our study population, a predominance of the male gender was noted. Given the socio-cultural context of the study location, where males often serve as the primary breadwinners, the inability to fulfill traditional family roles due to illness can induce significant financial and social stress. This shift in family role and subsequent loss of social participation may lead to elevated depression levels when physical functioning is poor, further emphasizing the link between functional independence and psychological health in this demographic.

The clinical implication of this study is significant: therapeutic protocols for chronic stroke patients, particularly those exhibiting poor balance and gait, must comprehensively integrate psychological screening and management. Focusing solely on physical impairment may overlook a major contributor to poor quality of life and suboptimal long-term prognosis. We recommend that physiotherapists proactively address the psychological health of chronic stroke patients, especially those with poor mobility, as an improved functional status promises both physical and emotional benefits.

The study acknowledges several limitations:

- The sample size was relatively small ($N=30$), partly attributable to constraints imposed by the ongoing COVID-19 pandemic at the time of recruitment, which may limit the generalizability of the findings.
- The study employed a cross-sectional correlational design, precluding any determination of a long-term prognosis or causal relationship between the outcome measures.
- The sample exhibited a major proportion of males, limiting the ability to draw conclusions about potential gender-based differences in the PSD-mobility relationship.

Conclusion

This study concludes that a strong negative correlation exists between the severity of depression and functional balance and mobility capabilities in patients with chronic stroke hemiparesis. Chronic stroke survivors with superior gait and balance exhibit significantly lower depression levels, suggesting better psychological health in individuals with improved physical function. These findings underscore the critical need to address both physical and psychological health in the comprehensive rehabilitation of chronic stroke patients to ensure a better quality of life and long-term prognosis.

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