(ISSN: 0973-7049(P))

The Bioscan AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES 21(3): S.I (3), 1089-1091, 2026 www.thebioscan.com

# ASSESSMENT OF BALANCE IMPAIRMENT AND FALL RISK USING CLINICAL BALANCE ASSESSMENT TOOLS IN PATIENTS WITH TRAUMATIC BRAIN INJURY: A CROSS-SECTIONAL STUDY

**[1]Shradha Hariom Tiwari , [2]Dr Dipika Balala,[3]Dr Deepak Lohar,[4]Dr Adil Raza Ansari,[5]Dr Jafar Khan**

1. M.P.Th. scholar, Pacific college of Physiotherapy, Pacific medical university, Udaipur, Rajasthan
2. Associate Professor, Pacific college of Physiotherapy, Pacific medical university, Udaipur, Rajasthan
3. Professor, Pacific college of Physiotherapy, Pacific medical university, Udaipur, Rajasthan
4. Assistant Professor, Pacific college of Physiotherapy, Pacific medical university, Udaipur, Rajasthan
5. Dean & HOD, Pacific college of Physiotherapy, Pacific medical university, Udaipur, Rajasthan

DOI: https://doi.org/10.63001/tbs.2026.v21.i03.S.I(3).pp1089-1091

**KEYWORDS**

*Traumatic brain injury, Balance, Fall risk, Functional Reach Test, Timed Up and Go Test, Single Leg Stand Test, Dizziness Handicap Inventory.*

**Article Info**

**Received:**27-06-2026

**Accepted:**14-07-2026

**Published:**24-07-2026

## Abstract

**Background**

Traumatic brain injury (TBI) frequently leads to long-term neurological deficits, including impaired balance, dizziness, and an increased risk of falls. These impairments negatively affect functional independence and quality of life. Accurate clinical assessment is essential for identifying balance deficits and planning appropriate rehabilitation strategies.

**Objective**

To evaluate neurological status, balance impairment, and fall risk in patients with traumatic brain injury and to examine the relationship between commonly used clinical balance assessment tools.

**Methods**

A cross-sectional observational study was conducted among 60 individuals diagnosed with traumatic brain injury. Neurological function was evaluated using the Glasgow Coma Scale (GCS), while balance and fall risk were assessed using the Dizziness Handicap Inventory (DHI), Functional Reach Test (FRT), Timed Up and Go Test (TUG), and Single Leg Stand Test (SLS). Descriptive statistics, dependent t-tests, Chi-square tests, and Spearman's rank correlation were used for data analysis.

**Results**

The mean age of participants was 37.68 ± 10.22 years, with males accounting for 58.33% of the sample. Most participants demonstrated right-sided neurological involvement (85%), and diabetes mellitus was the most common comorbidity (30%). Moderate dizziness-related disability was observed in 65% of participants. According to the Timed Up and Go Test, 60% of participants were at high risk of falls, while the Functional Reach Test classified 61.67% as having moderate fall risk. A statistically significant positive correlation was found between Functional Reach Test and Timed Up and Go performance ($r = 0.411$, $p = 0.001$), whereas no significant correlation was observed between Functional Reach Test and Single Leg Stand performance ($p > 0.05$).

**Conclusion**

Patients with traumatic brain injury exhibit substantial balance impairment and an increased risk of falls. The Functional Reach Test and Timed Up and Go Test provide complementary information regarding dynamic balance and mobility and should be incorporated into routine clinical assessment.

## Introduction

Traumatic brain injury (TBI) is one of the leading causes of disability worldwide and is associated with a wide range of neurological, cognitive, sensory, and motor impairments. Among these, disturbances in balance and postural control are particularly common and often persist long after the initial injury. Such impairments limit functional mobility, reduce participation in daily activities, and significantly increase the likelihood of falls.

Postural stability depends on the coordinated integration of visual, vestibular, and somatosensory information. Damage to any of these systems following traumatic brain injury can disrupt balance control, resulting in dizziness, gait abnormalities, and reduced functional independence. Persistent vestibular dysfunction has also been associated with delayed recovery, decreased quality of life, and poorer rehabilitation outcomes. Previous studies have demonstrated that vestibular rehabilitation can improve dizziness and mobility in individuals with TBI, emphasizing the importance of early identification of balance deficits.

Several clinical tools are routinely used to assess balance, including the Functional Reach Test (FRT), Timed Up and Go Test (TUG), and Single Leg Stand Test (SLS). Each evaluates different aspects of postural control and mobility; however, limited evidence exists regarding the relationship among these measures in individuals with traumatic brain injury. Understanding these relationships may assist clinicians in selecting the most appropriate assessment tools for rehabilitation planning.

Therefore, the present study aimed to evaluate balance impairment and fall risk in patients with traumatic brain injury using multiple clinical assessment tools and to determine the association between these measures.

## Materials and Methods

### Study Design

A cross-sectional observational study was conducted to assess balance impairment and fall risk in patients with traumatic brain injury.

### Participants

Sixty patients diagnosed with traumatic brain injury who fulfilled the study eligibility criteria participated in the study.

### Outcome Measures

The following standardized assessment tools were used:

- Glasgow Coma Scale (GCS)
- Dizziness Handicap Inventory (DHI)
- Functional Reach Test (FRT)
- Timed Up and Go Test (TUG)
- Single Leg Stand Test (SLS)

These tools were selected because they assess different components of neurological status, balance performance, and functional mobility.

### Statistical Analysis

Data were analyzed using SPSS software. Descriptive statistics summarized demographic and clinical variables. Dependent t-tests compared physiological parameters, Chi-square tests examined associations between categorical variables, and Spearman's rank correlation assessed relationships between balance measures. Statistical significance was established at $p < 0.05$.

## Results

A total of 60 participants were included in the study. The average age was 37.68 ± 10.22 years, with males representing 58.33% of the sample. Most participants belonged to the 31–40-year age group. Right-sided involvement was present in 85% of participants, while diabetes mellitus was identified as the most common associated comorbidity.

Neurological evaluation revealed considerable impairment across multiple domains. Most participants demonstrated abnormal eye, verbal, and motor responses on the Glasgow Coma Scale, indicating moderate to severe neurological dysfunction. Headache, dizziness, and visual disturbances were commonly reported symptoms, highlighting the broad impact of traumatic brain injury on neurological function.

Balance assessment showed that moderate dizziness-related disability was present in 65% of participants. According to the Timed Up and Go Test, 60% of participants were classified as having a high risk of falls. The Functional Reach Test identified moderate fall risk in 61.67% of participants, whereas the Single Leg Stand Test classified 35% as high risk.

Correlation analysis demonstrated a moderate positive relationship between Functional Reach Test and Timed Up and Go performance ($r = 0.411$,

p = 0.001), suggesting that better functional reach was associated with improved mobility. No statistically significant relationship was observed between Functional Reach Test and Single Leg Stand performance.

**Discussion**

The findings of the present study demonstrate that balance impairment is a prominent consequence of traumatic brain injury. Most participants exhibited moderate dizziness-related disability and were classified as having either moderate or high fall risk across the clinical assessment tools. These findings are consistent with previous reports indicating that vestibular dysfunction and impaired postural control are common following TBI.

The Timed Up and Go Test identified the greatest proportion of participants at high risk of falls, suggesting that functional mobility is substantially affected after traumatic brain injury. In contrast, the Functional Reach Test detected predominantly moderate impairment, indicating that although participants retained some limits of stability, dynamic mobility remained compromised.

The significant correlation between Functional Reach Test and Timed Up and Go performance indicates that these assessments evaluate related aspects of dynamic balance and mobility. The absence of a significant relationship between Functional Reach Test and Single Leg Stand performance suggests that static and dynamic balance involve different neuromuscular mechanisms and should be assessed independently during rehabilitation.

Collectively, these findings support the use of multiple standardized clinical balance assessments when evaluating individuals with traumatic brain injury, as no single test comprehensively captures all dimensions of postural control and fall risk.

**Clinical Implications**

- Routine assessment of balance should be incorporated into the rehabilitation of patients with traumatic brain injury.
- Combining the Functional Reach Test and Timed Up and Go Test provides a more comprehensive evaluation of dynamic balance and mobility.
- Early identification of individuals at high risk of falls may facilitate targeted balance training and vestibular rehabilitation.
- Multidisciplinary rehabilitation programs should address both neurological and balance impairments to improve functional outcomes.

**Limitations**

The present study included a relatively small sample size from a single clinical center, which may limit the generalizability of the findings. In addition, the cross-sectional design does not permit conclusions regarding causality or changes over time. Future multicenter longitudinal studies with larger sample sizes are recommended.

**Conclusion**

Patients with traumatic brain injury experience significant balance deficits, dizziness, and an elevated risk of falls. The Functional Reach Test demonstrated a significant association with Timed Up and Go performance, indicating that these measures complement one another in evaluating dynamic balance. Incorporating multiple clinical balance assessment tools into routine neurological rehabilitation may enhance clinical decision-making, improve fall prevention strategies, and optimize patient outcomes.