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Breaking the Fall: Strategies for Preventing Falls After Stroke - A Narrative Review

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Abstract: ***Falls are a common and serious complication among patients with stroke, contributing significantly to morbidity, prolonged hospitalization, and reduced quality of life. Post-stroke impairments such as motor weakness, balance deficits, visual disturbances, cognitive dysfunction, and sensory loss increase the risk of falls. Additionally, factors such as advanced age, polypharmacy, environmental hazards, and comorbid conditions further exacerbate this risk. Recurrent falls may lead to fractures, fear of falling, loss of independence, and increased caregiver burden. Assessment tools such as the Berg Balance Scale, Timed Up and Go Test, and Functional Independence Measure are commonly used to evaluate fall risk in stroke survivors. Preventive strategies include early risk assessment, individualized rehabilitation programs focusing on strength and balance training, environmental modifications, assistive devices, medication review, and patient and caregiver education. Multidisciplinary approaches involving physiotherapists, occupational therapists, and clinicians are essential for effective fall prevention. In conclusion, falls in stroke patients represent a significant yet preventable complication. Early identification of high-risk individuals and implementation of targeted interventions are crucial to improving functional outcomes and reducing healthcare burden.***

Keywords: Fall prevention, Elderly, Stroke rehabilitation, Fall in stroke

1. Introduction

Stroke is one of the leading causes of disability among elderly. Falls are one of the most common complications after stroke, with a reported incidence ranging between 7% in the first week and 73% in the first-year post stroke. (1) In geriatric medicine, falls are recognized as a major public health concern because they contribute to fractures, disability, institutionalization, reduced quality of life, and increased mortality.

Early identification of individuals at high risk of falling is essential in geriatric stroke care. Comprehensive geriatric assessment incorporating evaluation of gait, balance, cognition, vision, medication review, nutritional status, and environmental hazards can help identify modifiable risk factors.

With the growing aging population and increasing survival after stroke, preventing falls has become an integral component of comprehensive stroke rehabilitation and geriatric care. Understanding the multifactorial determinants of falls and implementing targeted preventive interventions are essential to reduce disability, improve long-term outcomes, and promote healthy aging among older stroke survivors.

2. Literature Search Strategy

A comprehensive literature search was conducted to identify studies evaluating the epidemiology, assessment, prevention, and management of falls in patients with stroke. Electronic databases, including **PubMed**, **Scopus**, **Web of Science**, **Embase**, and the **Cochrane Library**, were searched for articles published in **English** from **January 2000 to June 2026**. The search strategy combined Medical Subject Headings (MeSH) and free-text terms, including **"stroke," "cerebrovascular accident," "falls," "fall risk," "fall prevention," "balance," "gait," "rehabilitation, "assessment,"** and **"stroke rehabilitation,"** using Boolean operators (AND/OR).

3. Epidemiology

The life expectancy in India has increased to over 60 years in recent decades, resulting in a growing burden of age-related non-communicable diseases, including stroke. (2, 3) Consequently, stroke has emerged as the fourth leading cause of death and the fifth leading cause of disability in the country. The annual incidence of stroke in India is estimated to range from 105 to 172 per 100,000 population. (4)

Falls represent a major public health concern among older adults. In individuals aged 75 years and above, falls are the leading cause of accidental death, while among those aged 65–74 years, they are the second leading cause of accidental mortality, surpassed only by road traffic accidents. (5)

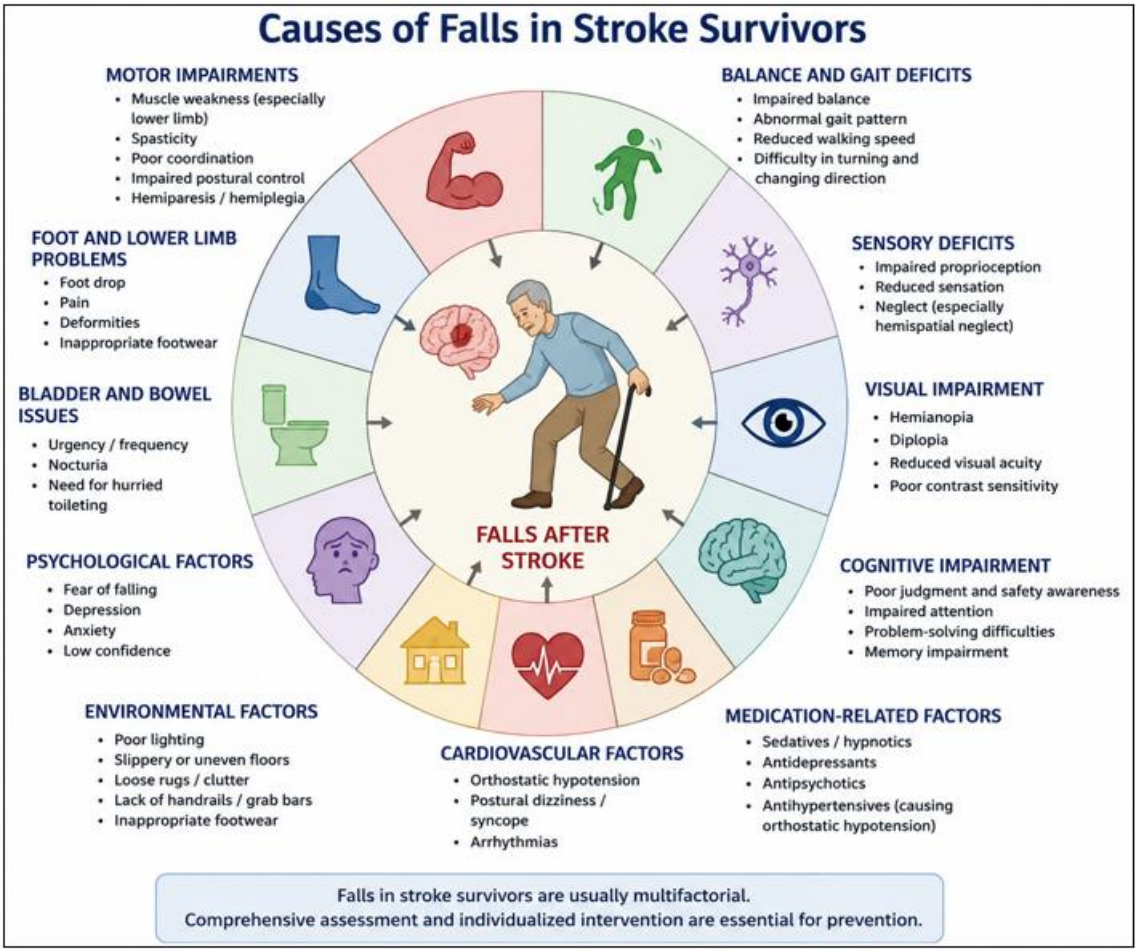
Approximately 30–70% of stroke survivors experience at least one fall within the first year after stroke, with the highest risk occurring during the first 3–6 months after the event, when mobility is improving but balance and motor control remain impaired. Recurrent falls occur in 20–40% of stroke survivors and are associated with a higher risk of fractures, fear of falling, reduced participation in rehabilitation, and poor quality of life. (6)

4. Causes of fall in stroke

- Motor impairment is one of the leading causes of falls after stroke. Weakness of the affected side (hemiparesis or hemiplegia), spasticity, poor coordination, and foot

drop impair walking and make activities such as standing, turning, and transferring from bed to a chair difficult. These deficits often result in an abnormal gait pattern and reduced ability to recover from a loss of balance.

- Balance impairment is another major contributor. Stroke affects the body's ability to maintain the center of gravity during standing and walking, leading to postural instability.
- Sensory deficits also play an important role. Impaired proprioception, reduced tactile sensation, visual field defects, and vestibular dysfunction decrease awareness of body position and surrounding obstacles. As a result, patients may misjudge distances, fail to detect hazards, or have difficulty navigating uneven surfaces.
- Cognitive and perceptual impairments significantly increase fall risk. Problems such as impaired attention, executive dysfunction, reduced safety awareness, and unilateral spatial neglect make it difficult for stroke survivors to recognize hazards or make appropriate decisions during mobility.
- Medical factors, including orthostatic hypotension, cardiac arrhythmias, fatigue, urinary urgency, and the adverse effects of medications such as sedatives and antihypertensive drugs, may further predispose patients to falls. Older adults are particularly vulnerable because of age-related muscle weakness, frailty, and multiple comorbidities.
- Environmental hazards frequently contribute to falls in stroke survivors. Poor lighting, slippery floors, loose rugs, uneven surfaces, cluttered walkways, and the absence of handrails or grab bars increase the risk, particularly in individuals with impaired mobility.



Advanced Fall Risk Assessment Methods in Stroke Patients

Advanced assessment methods provide objective evaluation of balance, gait, mobility, and postural control, enabling early identification of stroke survivors at high risk of falls.

- **Clinical balance assessment:** The Berg Balance Scale, Mini-Balance Evaluation Systems Test (Mini-BESTest), and Functional Gait Assessment are validated tools for evaluating dynamic balance and predicting falls.
- **Mobility tests:** The Timed Up and Go (TUG) Test and Five Times Sit-to-Stand Test assess functional mobility, lower-limb strength, and transfer ability. (7)
- **Instrumented gait analysis:** Three-dimensional motion capture systems, wearable inertial measurement units (IMUs), pressure-sensitive walkways (e.g., GAITRite System), and force platforms provide quantitative analysis of gait symmetry, walking speed, stride variability, and postural stability.
- **Posturography:** Computerized dynamic posturography objectively measures postural sway, sensory integration, and balance control, allowing precise identification of balance deficits.
- **Wearable sensor technology:** Accelerometers, gyroscopes, and smart insoles continuously monitor gait,

physical activity, and near-fall events in real-world settings, facilitating remote fall risk assessment.

Prevention of Falls in Stroke Patients

Falls after stroke can be reduced through a multifactorial approach that targets impairments in mobility, balance, cognition, vision, medications, and environmental hazards.

- **Routine fall risk assessment** should be performed in all stroke survivors to identify modifiable risk factors and guide individualized prevention strategies.
- **Early, supervised mobilization and rehabilitation** improve functional recovery and reduce complications associated with immobility while promoting safe mobility.
- **Balance and gait training** are the most effective rehabilitation interventions for reducing fall risk by improving postural stability and walking ability after stroke. (8)
- **Progressive lower-limb strengthening exercises** enhance muscle power and functional mobility, thereby reducing the likelihood of falls. (9)
- **Appropriate assistive devices**, such as canes, walkers, or ankle-foot orthoses, improve walking safety when prescribed according to the patient's functional status. (10)
- **Medication review**, particularly of sedatives, psychotropic drugs, and antihypertensives, helps minimize medication-related falls. (10)
- **Vision assessment and correction** should be incorporated into stroke rehabilitation, as visual impairment significantly contributes to falls.
- **Home hazard modification**, including improved lighting, installation of grab bars, removal of loose rugs, and use of non-slip flooring, effectively reduces fall risk after discharge.
- **Patient and caregiver education** regarding safe transfers, mobility techniques, and fall prevention measures improves adherence to safety recommendations.
- **Emerging technologies**, including wearable sensors, smart walkers, and virtual reality-based balance training, show promise in improving mobility and preventing falls, although further high-quality evidence is needed.
- Robotic gait training, FES, and body-weight-supported treadmill training currently have the strongest evidence for improving gait and balance after stroke. (11)
- Wearable sensors are highly accurate for detecting falls and can facilitate rapid emergency response, although they primarily detect rather than prevent falls.
- AI-enabled wearables and smart home technologies represent promising developments for continuous fall-risk monitoring but require further validation in stroke populations. (12)

5. Conclusion

Falls are a common and potentially preventable complication after stroke that significantly affect recovery, independence, and quality of life. Their occurrence is influenced by multiple factors, including motor, sensory, cognitive, and environmental impairments, highlighting the need for a comprehensive and multidisciplinary approach to prevention. Early risk assessment, individualized rehabilitation, patient and caregiver education, and appropriate use of assistive and emerging technologies can reduce fall risk and improve functional outcomes. Incorporating evidence-based fall prevention strategies into routine stroke care is essential to promote safe mobility, enhance long-term recovery, and reduce the overall burden of stroke-related disability.

Conflict of Interest: None of the authors has any conflict of interest to disclose.

Ethical approval: The study is in accordance with the ethical standards of the institution.

We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

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