

Analysis of Fall Incidence Rate and Risk Factors at a Tertiary Care Hospital Setting for Inpatient Neurological Care using the Morse Fall Scale: A Prospective Study

RIYA ROY¹, PURUSOTHAM CHIPPALA²

ABSTRACT

Introduction: Falls are the most common adverse events related to a patient safety in healthcare institutions. Falls during hospitalisation, particularly in inpatient rehabilitation facilities, are a common phenomenon among hospitalised individuals. The rationale of the present study is to reduce the incidence of falls by early identification of fall risk using an outcome measure.

Aim: The aim of this study is to identify the fall incidence rate and associated factors responsible for falls in inpatients with neurological diseases using the Morse Fall Scale (MFS).

Materials and Methods: This prospective study included 128 patients hospitalised in the Medicine and Neurosurgery Units of Justice KS Hegde Charitable Hospital in Mangaluru, Karnataka, Southern India. The study was conducted from March 2022 to March 2023. Factors were analysed through direct patient interviews, and fall risk scores were identified using the MFS during admission and discharge. Categorical variables were presented as frequency and percentage, while descriptive variables were presented as Mean±Standard Deviation. The

pre-post comparison of the outcome measure was conducted using the Z-test.

Results: The fall incidence rate in neurological inpatients was found to be 15 (11.7%), and the majority of the population belonged to moderate to high-risk of falls. During the hospitalisation period, 99 (77.3%) individuals had a fear of falling, while 29 (22.7%) did not have any fear of falling. Among the study population, 113 (88.3%) had no falls during their hospitalisation, while 15 (11.7%) experienced falls. The majority of subjects had a moderate risk of falls: 63 (49.2%) upon admission and 68 (53.1%) at discharge. There was a significant difference in the MFS scores between admission and discharge (p-value=0.024).

Conclusion: The present study concludes that the MFS enables the identification of individuals at risk of falling. The variables related to these findings were the use of continuous medications, balance issues, fear of falling, followed by other factors such as age, length of hospital stay, previous hospitalisation, and sensory disorders.

Keywords: Fall risk, Hospitalisation, Incidence of fall, Neurological conditions

INTRODUCTION

Falls are the most common adverse events related to a patient safety in healthcare institutions [1]. They result in significant injuries, decreased functional capacity, and reduced quality of life for patients, leading to extended hospitalisation and increased healthcare or medical costs [2]. A study reported that falls among inpatients were caused by a combination of many risk factors, including acute and chronic diseases, the long-term effects of these diseases, the aging process, adverse effects of medication, and an unfamiliar hospital environment. Previous studies on falls have found that neurological patients have a high-risk of falling [3] and that falls are more prevalent in neurological services [4]. Hunderfund AN et al., found that the rate of falls in Neurology Departments was 5.69 per 1000 patients/day, with neurological inpatients having a higher percentage of falls [5]. Many efforts are being made to find a better assessment tool and the best means for fall prevention and prediction of the risk of falling during a hospital stay. However, falls remain a major public health concern [5,6]. Consequently, there is an ongoing effort to develop risk assessment tools to identify patients with an increased risk of falling as soon as they are hospitalised. Many studies state that the most common assessment tool used in fall-related clinical trials is the MFS [6-10], but there is limited evidence on how MFS can determine patients' fall risk in an inpatient neurological hospital setting and what factors within the setting are predictive of the risk of falling during hospitalisation. The negative consequences of falls within a hospital affect not only the patients but also the caregivers and healthcare facilities. Patients require longer recovery

time, impact rehabilitation facilities, and experience increased pain or injuries [11,12]. As a result, there has been a shift in focus from a reactive medical approach to a preventive medical approach, with a subsequent emphasis on identifying ways to prevent falls even before they occur during the hospitalisation period. Therefore, prediction and prevention falls is an important part of the process of creating a safer environment for patients, reducing fall-related healthcare costs, and improving overall patient satisfaction scores [13,14]. The MFS is the most commonly used screening tool in many acute and tertiary care hospital settings to predict the risk of falls [10]. Hence, to identify patients who require preventive measures and their specific risk factors and to prevent falls from occurring, the MFS can be used [8]. An important goal of using the MFS for the present study was to identify why the patient is at risk of falling and thus focus on the areas of risk identified by the MFS to target specific interventions that can prevent patients from falling. The research question here is whether the MFS helps in identifying risk categories and the incidence rate of falls, as well as whether it is possible to identify risk factors associated with falls using the same tool. Therefore, the purpose of the study was to analyse the fall incidence rate using the MFS and identify the risk factors for falls in an inpatient neurological tertiary care hospital setting.

MATERIALS AND METHODS

The present prospective study was conducted from March 2022 to March 2023. The participants were patients admitted to the Medicine and Neurosurgery Units of Justice KS Hegde Charitable Hospital

in Mangaluru, Karnataka, India. Ethical clearance for the study was obtained from Nitte Institute of Physiotherapy's Institutional Ethics Committee, Mangaluru, Karnataka, India, with reference number NIPT/IEC/Min/17/2021-2022, dated 12-02-2022. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1975, revised in 2013.

The sample size calculation was based on time-bound sampling to obtain the fall rate during the period from March 2022 to March 2023.

Inclusion criteria: Patients willing to participate in the study, patients diagnosed with any neurological disease, admission as inpatients in the medicine and neurosurgery units, length of hospital stay greater than seven days, age above 18 years and less than or equal to 85 years, both male and female were included in the study.

Exclusion criteria: Bedridden or unconscious patients, neurological disorders combined with orthopaedic complications (amputation, coronary artery bypass graft, spinal cord injury, etc.), patients taking any psychiatric medications, patients with cognitive impairments, patients within the facility who experienced a syncopal episode resulting in a fall, patients with advanced dementia documented in the medical record were excluded.

Study Procedure

Patients were screened based on the inclusion and exclusion criteria using a data screening tool. Data was collected via a data collection form. The purpose and procedure of the study were explained, and written consent was obtained from the subjects. The patients diagnosed with any neurological condition and admitted as inpatients in the medicine and neurosurgery units with a hospital stay of more than seven days were included. Once patients were accepted, they were given a consent form that included explanatory information about the study and its implications, encouraging patients to participate in the research. Data extraction for the outcome measure was done by MFS, which was attached within the patient file. The MFS scores were recorded on a daily basis by nursing staff from the day of admission until discharge, as well as at every shift change and whenever indicated (such as change in location, condition, treatment, or after a fall).

The data obtained from the patients included age, gender, length of hospital stay, unit type, primary diagnosis, perceived health [15], chronic diseases present, previous hospitalisation, sensory disorders, use of continuous medications, balance issues, fear of falling, number of falls during hospitalisation, time of falls, reasons for falls, as well as MFS scoring during admission and follow-up during discharge.

Two sets of data were collected from each patient-one upon admission and another during follow-up at the time of discharge. Using the MFS, the patient was classified into low risk (0-24), moderate risk (25-44), or high-risk category (45+) [16]. Upon discharge, a data collection sheet was filled out, which included all the relevant variables of the study, including risk factors and incidences of falls, if experienced during the period of hospitalisation.

The MFS scale was developed to focus on the patient's history of falling, secondary diagnosis, utilisation of ambulatory aids, use of intravenous saline locks, gait/transferring, and mental status. A study found that the MFS has a sensitivity of 95.2% and specificity of 64% [16]. It assigns a score between 0-125, with higher scores indicating a higher risk of falling.

STATISTICAL ANALYSIS

The collected data were analysed using Statistical Package for Social Sciences (SPSS) 20.0. Descriptive statistics were used to analyse the data. Categorical variables were presented as frequency

and percentage, while descriptive variables were presented as mean±standard deviation. The pre-post comparison of the outcome measure was performed using the Z-test. A p-value <0.05 was considered statistically significant.

RESULTS

The study included a total of 128 participants with an average age of 52.53±16.69 years. Among them, the majority (40.0%) were between the ages of 38-57 years, followed by 35.2% between 59-77 years, 18.8% between 18-37 years, and 5.5% aged 78 years or older. Among the study population, 80 (62.5%) had a previous history of hospitalisation, while 48 (37.5%) were not previously hospitalised.

The results of the study showed that the conditions identified to have an increased risk of falls were acute and chronic cerebrovascular accidents 57 (44.5%), multiple sclerosis 11 (8.6%), Parkinson's disease 8 (6.3%), and various types of neuropathies 7 (5.5%), followed by other neurological conditions [Table/Fig-1].

Primary diagnosis	Frequency (n)	Percent (%)
Acute CVA and chronic CVA	57	44.5
Bell's palsy	3	2.3
Encephalopathy	4	3.1
Haematoma	4	3.1
Multiple sclerosis	11	8.6
Neuropathy	7	5.5
Parkinson's disease	8	6.3
Transverse myelitis	3	2.3
Traumatic brain injury	4	3.1
Others conditions	27	21.2
Total	128	100.0

[Table/Fig-1]: Primary diagnosis of the study population.

In the present study, the majority of participants 20 (15.6%) had hypertension (systemic), 5 participants (3.9%) had Type 2 Diabetes Mellitus, and approximately 17 participants (13.3%) had both hypertension and diabetes mellitus as chronic conditions. Chronic Obstructive Pulmonary Disorder (COPD) was present in 2 participants (2.3%), previous infarct in 2 participants (1.56%), and other chronic conditions in 1 participant (0.7%). Furthermore, 94 participants (73.4%) were taking continuous medication for their chronic conditions.

Among the population, the majority of 102 participants (79.7%) did not have any sensory disorders. Visual disorders were observed in 20 participants (15.6%), while auditory disorders and both auditory and visual disorders were present in 3 participants (2.3%) each.

Regarding the risk of falling, the majority of the study population was in fair health 58 participants (45.3%), followed by good health 37 participants (28.9%), and poor health 33 participants (25.8%). In terms of medication usage, 94 participants (73.4%) had a history of taking continuous medications, while 34 participants (26.6%) did not.

During hospitalisation, the study identified that the majority of the population 99 participants (77.3%) experienced balance issues, while 29 participants (22.7%) did not [Table/Fig-2]. Similarly, 99 participants (77.3%) had a fear of falling, while 29 participants (22.7%) did not [Table/Fig-2].

Regarding falls during hospitalisation, 113 participants (88.3%) did not experience any falls, while 15 participants (11.7%) did [Table/Fig-3]. Among those who fell, the majority 114 participants (89.1%) did not experience falls at any specific time of the day. However, 7 participants (5.4%) fell during the day, 5 participants (3.9%) fell during the night, and 1.6% fell during both day and night. The causes of falls varied, with 3.9% falling due to dizziness and loss of balance, 1.6% due to slip and fall, and 0.8% each due to tremors and weakness.

Risk factors	Frequency (n)	Percent (%)
Previous hospitalisation	80	62.5
Continuous medication	94	73.4
Balance issues	99	77.3
Fear of fall	99	77.3
Sensory disorder- visual, auditory, both	26	20.2
Perceived health- fair	58	45.3
Good	37	28.9
Poor	33	25.8
Chronic disease present	59	46.1

[Table/Fig-2]: Major risk factors associated with fall.
*(No patients in the present study had excellent and very good perceived health)

Fall during hospitalisation	Frequency (N)	Percent (%)
No	113	88.3
Yes	15	11.7
Total	128	100.0

[Table/Fig-3]: Number of falls during period of hospitalisation of the study population.

There was a significant difference in the scores of the Modified Falls Efficacy Scale (MFS) between admission and discharge (p -value=0.024) [Table/Fig-4]. The majority of participants had a moderate risk of falling, both at admission 63 participants (49.2%) and at discharge 68 participants (53.1%) [Table/Fig-5].

Morse Fall Scale (MFS) score	N	Mean	Std. Deviation	z-value	p-value
Admission	128	41.015	20.992	2.294	0.024
Discharge	128	43.437	19.977		

[Table/Fig-4]: Morse Fall Scale (MFS) score during admission and discharge.

Risk category	Admission (N=128)		Discharge (N=128)	
	Frequency (n)	Percent (%)	Frequency (n)	Percent (%)
Low risk	23	18.0	16	12.5
Moderate risk	63	49.2	68	53.1
High risk	42	32.8	44	34.4
Total	128	100.0	128	100.0

[Table/Fig-5]: Fall risk categorisation of the study population according to Morse Fall Scale (MFS).

DISCUSSION

Falls can be caused by various risk factors, including disease conditions, medication use, disorders, and fears related to balance and falling. Aging can also contribute to fragility, and environmental factors such as flooring, lighting, bed heights, slopes, and unfamiliar hospital conditions can further increase the risk. Additionally, previous hospitalisation may impact an individual's overall health status. These factors, along with others, can contribute to falls. As part of a shift from a reactive medical approach to a preventive medical approach, there is great importance and a need to identify falls. The present study focuses on identifying the incidence of falls in a neurological inpatient hospital setting, as previous studies have identified that neurological patients have the highest risk of fall-related complications and a high incidence of falls.

While it has been found in a previous study [17] that falls among inpatients lead to serious complications and risks, the literature contains limited research on the incidence of falls among inpatient neurological patients and the associated risk factors [3,4,11]. The present study aimed to identify the fall incidence rate and risk factors in a neurological inpatient rehabilitation setting, as well as to determine the usefulness of the Modified Falls Efficacy Scale (MFS) in predicting the risk of falls.

During the study period, 11.7% of all patients fell once or more often. Balance and gait disturbances, as well as fear of falling, were

identified as the main causes of falls in 77.3% of cases. Intrinsic risk factors for falls included age (52.53 ± 16.69 years), gender (male-60.9%), gait disturbances, balance issues, and a fear of falling. External factors that contributed to falls were the length of hospital stay, continuous medication usage, sensory disorders, previous hospitalisation, and fear of falling. Among the diagnosis, falls were most frequent in acute and chronic cerebrovascular accidents (44.3%), multiple sclerosis (8.6%), Parkinson's disease (7.1%), and various types of neuropathies (5.5%), followed by other neurological conditions. The majority of the study population at risk of falling had fair health (45.3%), followed by good health (28.9%) and poor health (25.8%). Falls in neurological patients are particularly associated with medications and disorders that affect gait and balance. Notably, a previous history of falls was associated with an increased risk of future falls.

In the present study, it was found that among the patients who experienced falls, approximately 82% had a moderate to high risk of falling at the time of admission, while 87.5% had the same risk during discharge. Another study by Koç Z et al., reported that 11.4% of neurological patients had a risk of falling, while 70.3% had no risk. As indicated in many pieces of literature, the internal structure of hospitals, including lighting, flooring, and other infrastructural facilities, as well as the implementation of fall prevention programs and injury management, are of great importance in reducing the incidence of falls among neurological inpatients [2].

The present study found that 20.2% of participants had sensory disorders, with 15.6% having visual disorders and 2.3% each having auditory and both auditory and visual disorders. Other studies have shown that approximately 29.4% of participants had sensory disorders, with 21.2% having visual issues. Adverse events related to sensory and auditory issues may contribute to an increased risk of falls [2]. Morse JM studied the various factors that can cause falls, highlighting the importance of hospital workers and healthcare providers taking preventive measures to reduce or eliminate these risk factors. Screening for falls and implementing fall prevention measures within hospitals and rehabilitation facilities are crucial for patient safety [7,8,18,19].

The present study found that the majority of falls occurred during the day (5.5%), followed by night (3.9%) and during both day and night (1.6%). The higher number of falls during the day in the present study may be due to patients being more active and meeting their personal care needs [4]. However, a study by Koç Z et al., found that falls mostly occurred during the day and afternoon [2]. Another study by Hitcho EB et al., found that 58.5% of falls occurred at night, usually between 7 pm and 6 am [4]. Lovallo C et al., reported that falls were more predominant at night due to problems patients faced with bowel and bladder issues, leading them to need to use the bathroom frequently at night [20].

The present study found that the majority of falls were due to dizziness and loss of balance (3.9%), followed by slip and fall (1.6%), and tremors and weakness (0.8%). Previous studies have also identified dizziness and loss of balance as significant causes of falls. Other studies have found that falls can be attributed to factors such as wet floors, poor lighting, inadequate footwear, walking barefoot, slippery ground, posture and gait disorders, malfunctioning wheelchairs, fainting, and vertigo. Albernaz PL and Cabral FS reported that neurological patients experience dizziness and loss of balance more frequently, leading to a higher incidence of falls [9].

In the present study, the majority (15.6%) had hypertension (systemic), 3.9% had Type 2 diabetes mellitus, and approximately 13.3% had both hypertension and diabetes mellitus as chronic conditions. Other chronic conditions included COPD (2.5%), previous infarct (1.6%), and other chronic diseases (0.8%). The majority of participants (73.4%) were taking continuous medication for their chronic conditions.

A study by Özden D et al., reported similar findings, identifying that patients with neurological conditions had chronic diseases such as hypertension, coronary artery disease, and diabetes mellitus (83.7%, 41.8%, and 28.3% respectively), and most of them used continuous medications (94.6%) [10]. Another study by Stolze H et al., found that antihypertensive, antidepressants, and diuretics were risk factors for falls. The results of the present study suggest that patients who have a risk of falling and are taking continuous medications for these diseases should be closely monitored for adverse effects of the medication that could increase the risk of falling [11].

The present study helped identify important risk factors for falls in neurological inpatients in a tertiary care hospital setting. The most significant risk factors identified were the use of continuous medications (73.4%), balance issues, and fear of falling (77.3% each). Other risk factors included age (52.53±16.69 years), length of hospital stay (12.90±6.38 days), previous hospitalisation (62.5%), and sensory disorders (20.2%). The Modified Falls Efficacy Scale (MFS) showed a statistically significant increase in scores during discharge compared to admission (p-value=0.024), indicating its effectiveness in reducing fall incidences.

Limitation(s)

One limitation of the study is that although a large percentage of patients were at risk of falling (82% moderate risk, 87.5% high risk), only a minority (11.7%) actually experienced falls during their hospital stay. Further differentiation of the high-risk population based on patient characteristics may improve the prediction of falls. Despite the prospective assessment methods used, it is still possible that some falls were missed, and the reported incidence of falls may be an underestimate. Perhaps only highly sophisticated long-term monitoring methods would be able to provide the true incidence of falls, but these would be impractical. The present study aimed to identify the incidence rate of falls and the associated risk factors in an inpatient neurological tertiary care hospital setting. The present study results suggested that the Modified Falls Efficacy Scale (MFS) could accurately identify the incidence of falls, even though only a minority of patients experienced falls. This demonstrates the efficiency of the scale in preventing falls by enabling the implementation of preventive measures and reducing the consequences of falls.

CONCLUSION(S)

The study found that approximately 11.7% of neurological inpatients who were categorised as moderate to high risk of falls according to the MFS experienced falls. The variables associated with these findings were the use of continuous medications, balance issues, fear of falling, as well as other factors including age, length of hospital stay, previous hospitalisation, and sensory disorders.

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PARTICULARS OF CONTRIBUTORS:

- Postgraduate Student, Department of Physiotherapy, Nitte Institute of Physiotherapy, Mangaluru, Karnataka, India.
- Professor, Department of Physiotherapy, Nitte Institute of Physiotherapy, Mangaluru, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Purusotham Chippala,
Professor, Nitte Institute of Physiotherapy, Nitte Deemed to be University,
Mangaluru-575018, Karnataka, India.
E-mail: chippala_puru@nitte.edu.in

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