



FALL RISK ASSESSMENT IN ISCHEMIC AND HEMORRHAGIC STROKE PATIENTS ADMITTED TO A SUPER SPECIALTY TERTIARY CARE HOSPITAL IN NORTHEAST INDIA

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ABSTRACT **Aim:** Falls during hospitalization are a serious concern. The aim of this study was to ascertain risks of fall among the hospitalized stroke patients. **Methods:** This was a retrospective study of 195 stroke patients admitted to the Neurology Department. Morse Fall Scale (MFS) tool was used to assess the risk of fall. **Results:** The cohort included 60 % (n = 117) ischemic stroke and 40 % (n = 78) hemorrhagic stroke patients. Mean age of the patients was 58.3 yrs $\pm$ 1.368 with a male/female ratio of 1.8:1. Patients scored high on the MFS items: secondary diagnosis (57.9 %; n = 113) and intravenous device use (68.2 %; n = 133). About 35.9 % (n = 70) patients were classified as high fall risk. Severe post-stroke pain was observed in 39 % patients (n = 76). Mortality was 6.7 % (n = 13). **Discussion:** Early identification of risk situations and appropriate fall-risk prevention strategies are crucial for reducing the incidence of falls and for ensuring continuous patient safety and quality of care.

KEYWORDS : Assessment, hemorrhagic, ischemic, risk, stroke

INTRODUCTION

Falling during hospitalization is a frequently occurring phenomenon that can result in injuries particularly for elderly patients or those with mobility issues.^{1,2} The incidence of fall is one of the main adverse and concerning events that hospitals need to prevent.^{3,4,5,6} Falls can lead to serious injuries, prolonged hospital stays, increased healthcare costs, and even fatalities.⁷ Thus, the incidence of fall can interfere with the recovery of the patient and is directly related to patient safety.⁸ Hospitals therefore need to adopt and implement fall-prevention programs and protocols and better assessment of risk of fall during hospitalization to ensure patient safety.⁹ Identifying and assessing patient characteristics are essentials steps in fall prevention.¹⁰ Characteristics that include mobility limitations, cognitive abilities, sensory deficits, psychological status, history of fall, medication use, acute/chronic illnesses, and environmental factors play significant roles in fall risk.¹¹ Hence, use of specific tools that can identify individuals that are susceptible to falling can help in the development of effective fall prevention strategies.⁵ In this study, the global and widely used tool known as the Morse Fall Scale (MFS) was used for assessing a patient's risk of falling.¹² There are plethora of studies in literature that have undertaken fall risk assessment in adult hospitalized patients.^{13,14,15,16} In India, there is lack of such studies that investigate the risk of falls in stroke patients during hospitalization. Therefore, the goal of this study was to assess the risk of falls in hospitalized stroke patients and to identify the factors that increase the likelihood of falls so that healthcare professionals of this hospital can better tailor interventions to improve patient safety and quality of care.

MATERIAL AND METHODS

This cohort study was conducted from 1st July to 31st December 2022. The data collection started by reviewing the medical records from the medical records department (MRD) of the hospital. All hospitalized ischemic and hemorrhagic stroke patients above 18 yrs of age with confirmed computerized tomography (CT) or magnetic resonance imaging (MRI) scans and complete medical records were included. Patients who were less than 18 yrs of age and with incomplete medical records were excluded. Fall risks assessment was done using the MFS tool. Patients that scored between 0 and 25 points were at low risk of falls; patients with scores between 25 and 44 points were at moderate risk of falls; and those with 44 or more points were at high risk of falls

during hospitalization. Post-stroke pain assessment was performed with the help of numeric pain rating scale (NPRS).¹⁷ Patients classified between 1 and 3 points indicated mild pain; patients classified between 4 and 6 points indicated moderate pain; and patients between 7 and 10 points were at severe pain. Statistical analysis of the extracted data was carried out using the SPSS software version 17.¹⁸ Categorical variables were expressed as numbers (n) and percentages (%). Statistical analysis was carried out using the chi-square test. Statistical significance was considered when *P* values were < 0.05.

RESULTS

The overall cohort comprised of 195 stroke patients (124 males; 63.6 % vs 71 females; 36.4 %) with a male/female ratio of 1.8:1. There were 117 ischemic stroke patients that consisted of 72 males (61.5 %) and 45 females (38.5 %). Hemorrhagic stroke patients included 54 males (69.2 %) and 24 females (20.8 %). Mean age was 58.3 yrs $\pm$ 1.368.

About 66.6 % (n = 26) ischemic and 33.4 % (n = 13) hemorrhagic stroke patients had a history of fall during investigation. In case of secondary diagnosis, 65.9 % (n = 54) ischemic and 34.1 % (n = 28) hemorrhagic stroke patients were presented with more than one medical diagnosis. With regards to help in walking, 35.7 % (n = 5) ischemic and 64.3 % (n = 9) hemorrhagic stroke patients did not need any assistance but held onto furniture or wall or rail while walking; 69.2 % (n = 18) ischemic and 30.8 % (n = 8) hemorrhagic stroke patients needed crutches or cane or walker while walking; and 60.6 % (n = 94) ischemic and 39.4 % (n = 61) hemorrhagic stroke patients had normal walking or did not walk or were totally bedridden or used wheelchair or required help by health professional. Use of intravenous device was seen in 53.4 % (n = 71) ischemic and 46.6 % (n = 62) hemorrhagic stroke patients. In case of walking, 61.1 % (n = 11) ischemic and 38.9 % (n = 7) hemorrhagic stroke patients had impaired walking; 54.2 % (n = 45) ischemic and 45.8 % (n = 38) hemorrhagic stroke patients showed weak walking; and 64.9 % (n = 61) ischemic and 35.1 % (n = 33) hemorrhagic stroke patients had either normal walking or were immobile or were in complete bed rest. Considering mental status, 56.3 % (n = 18) ischemic and 43.7 % (n = 14) hemorrhagic stroke patients forgot their limitations during the course of investigation.

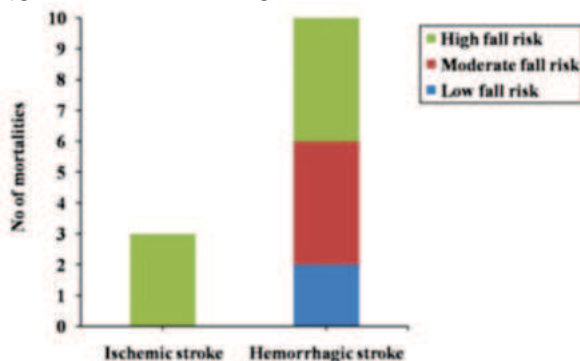
Table I: Distribution Of Stroke Patients According To Items Of Morse Fall Scale (MFS)

Item Morse Fall Scale (MFS)	N (%)	Ischemic stroke n (%)	Hemorrhagic stroke n (%)	p
History of falls (within 3 months)				
Yes	39 (20)	26 (66.6)	13 (33.4)	0.0373
No	156 (80)	91 (58.3)	65 (41.7)	0.0373
Secondary diagnosis (Two or more)				
Yes	113 (57.9)	63 (55.8)	50 (44.2)	0.2212
No	82 (42.1)	54 (65.9)	28 (34.1)	0.0040
Ambulatory aids				
Furniture/wall/rail	14 (7.2)	5 (35.7)	9 (64.3)	0.2850
Crutches/cane/walker	26 (13.3)	18 (69.2)	8 (30.8)	0.0498
None/bed rest/wheel chair/nurse	155 (79.5)	94 (60.6)	61 (39.4)	0.0080
Use of intravenous device				
Yes	133 (68.2)	71 (53.4)	62 (46.6)	0.4351
No	62 (31.8)	46 (74.2)	16 (25.8)	0.0001
Gait				
Impaired	18 (9.2)	11 (61.1)	7 (38.9)	0.3457

Table III: Distribution Of Stroke Patients Based On Numeric Pain Rating Scale (NPRS) And Morse Fall Scale (MFS) Classifications.

	Fall risk (Ischemic stroke)					Fall risk (Hemorrhagic stroke)				
Pain characteristics	N (%)	Low n (%)	Moderate n(%)	High n (%)	p	Low n (%)	Moderate n (%)	High n (%)	p	
Mild	53 (27.2)	6 (11.3)	13 (24.5)	8 (15.1)	0.2358	6 (11.3)	12 (22.6)	8 (15.1)	0.3406	
Moderate	66 (33.8)	6 (9.1)	18 (27.3)	13 (19.7)	0.0522	4 (6.1)	14 (21.2)	11 (16.7)	0.0656	
Severe	76 (39)	8 (10.5)	22 (28.9)	23 (30.3)	0.0186	7 (9.2)	9 (11.8)	7 (9.2)	0.8403	

Patients with ischemic stroke had mortality of 2.6 % (n = 3) and had high risk of falling during their hospitalization. Whereas, mortality was 12.8 % (n = 10) in hemorrhagic stroke patients and about 80 % (n = 8) patients were predicted with moderate to high fall risk and 20 % (n = 2) patients showed low fall risk prediction.

**Fig 1: Distribution of patients based on mortality and MFS classification**

DISCUSSION

Falls during hospitalization is a major public health scare. It can have significant implications including physical, economic, and social consequences for patients and their families. Few studies are there in literature that has investigated the risks of falls among patients presented with different chronic illnesses during hospitalization.^{6,7,8,9,10,11, 14,15,19,20,21} However, considering stroke there is lack of such studies in India. This study is thus an attempt to ascertain risks of fall among the hospitalized adult stroke patients in a tertiary care hospital in Northeast India.

In the present study, stroke was more prevalent in males as compared to females which were similar to earlier studies.^{22,23,24,25} This can be attributed to greater presence of harmful habits in males such as tobacco use, alcohol intake, sedentary life styles etc. The low

Weak	83 (42.6)	45 (54.2)	38 (45.8)	0.4422
Normal/bed rest/immobile	94 (48.2)	61 (64.9)	33 (35.1)	0.0038
Mental Status				
Forgets limitation	32 (16.4)	18 (56.3)	14 (43.7)	0.4795
Oriented to own ability	163 (83.6)	99 (60.7)	64 (39.3)	0.0061

According to the MFS classification, 35.9 % (n = 70) patients were classified as high risk for falls that consisted of 62.9 % (n = 44) ischemic and 37.1 % (n = 26) hemorrhagic stroke patients. Moderate risk for falls was predicted in 45.2 % (n = 88) patients comprising of 60.2 % (n = 53) and 39.8 % (n = 35) ischemic and hemorrhagic stroke patients respectively. Approximately, 18.9 % (n = 37) were classified as low risk for falls that included 54.1 % (n = 20) ischemic and 45.9 % (n = 17) hemorrhagic stroke patients.

Table II: Distribution Of Stroke Patients According To Risk Classification On The Morse Fall Scale (MFS)

Classification of risk for falls- Morse Fall Scale (MFS)	N (%)	Ischemic stroke n (%)	Hemorrhagic stroke n (%)	p
Low	37 (18.9)	20 (54.1)	17 (45.9)	0.6218
Moderate	88 (45.2)	53 (60.2)	35 (39.8)	0.0550
High	70 (35.9)	44 (62.9)	26 (37.1)	0.0314

Post-stroke pain that included mild (27.2%; n = 53), moderate (33.8%; n = 66), and severe intensities (39%; n = 76) was noted. Only ischemic stroke patients with severe post-stroke pain showed statistical significance in terms of fall risk classifications (p = 0.0186).

percentage of females could also be either due to gender biasness or reluctance to seek medical care. Mean age of the cohort was relatively low. This result is similar to a study by Sylaja et al and contradicts the results from Western and Chinese populations where a higher mean age have been reported.^{22,23,24,25} There are reports of stroke happening at a few earlier years in developing nations as compared to Western nations. This may be due to uncontrolled common modifiable risk factors and the existence of nontraditional risk factors. Community-based studies are thus necessary to avoid any discrepancies that may arise from hospital-based studies.

This study showed higher percentage of ischemic and hemorrhagic stroke patients who scored on the MFS items: secondary diagnosis and use of intravenous device. This was comparable to a few other studies in literature.^{9,26,27} Both secondary diagnosis and intravenous device use needs to be considered in assessing a patient's risk of falling for designing appropriate fall prevention strategies. The health care providers should better identify the patients who may be at increased risk of falling due to impairments in mobility or balance and the need to use walking accessories.⁹ Educating the patients and their carers to implement appropriate preventions to prevent fall can ensure patient safety.

According to the MFS classification, a higher percentage of ischemic and hemorrhagic stroke patients were classified at moderate and high risk of falls. Use of MFS tool to classify hospitalized patients for risk of fall has been performed in earlier studies.^{9,26}

Post-stroke pain was seen in most of the patients which varied from mild to severe. Post-stroke pain is a common complication of stroke and is associated with disability and reduced quality of life.²⁸ In this study, patients with severe post-stroke pain showed moderate to high risk of fall during investigation urging the need for appropriate treatment and management of post-stroke pain to have a better quality of life after a stroke.

Mortality rate was low within the cohort. This could be due to the patients leaving the hospital against medical advice when their condition worsened. High risk of fall was predicted within these

patients before their demise during their stay at the hospital.

The limitations of this study include single centre retrospective study and small sample size that can introduce biases or confounding factors. Thus, multicentre studies may be needed to validate the results and enhance the robustness of the findings.

REFERENCES

1. Hartholt KA, van der Velde N, Looman CWN, van Lieshout EMM, Panneman MJM, van Beeck EF, et al. Trends in fall-related hospital admissions in older persons in the Netherlands. *Arch Intern Med* 2010;170:905-11.
2. Haines TP, Hill AM, Hill KD, Brauer SG, Hoffmann T, Etherton-Beer C, et al. Cost effectiveness of patient education for the prevention of falls in hospital: economic evaluation from a randomized controlled trial. *BMC Med* 2013;11:135.
3. Miale-Lye IM, Hempel S, Ganz DA, Shekelle PG. Inpatient fall prevention programs as a patient safety strategy: a systematic review. *Ann Intern Med* 2013;158:390-96.
4. Ganz DA, Huang C, Saliba D, Shier V. Preventing falls in hospitals: a toolkit for improving quality of care (Prepared by RAND Corporation, Boston University School of Public Health, and ECRI Institute under Contract No. HHS2902010000171 TO #1). Rockville, MD: Agency for Healthcare Research and Quality 2013.
5. Hempel S, Newberry S, Wang Z, Paul GS, Shanman RM, Johnsen B, et al. Review of the Evidence on Falls Prevention in Hospitals: Task 4 Final Report. Santa Monica, Calif.: RAND Corporation, WR-907-AHRQ2012 2014.
6. Oliver D, Healey F, Haines TP. Preventing falls and fall-related injuries in hospitals. *Clin Geriatr Med* 2010;26:645-92.
7. LeLaurin JH, Shorr RI. Preventing Falls in Hospitalized Patients: State of the Science. *Clin Geriatr Med* 2019;35:273-83.
8. Abreu C, Mendes A, Monteiro J, Santos FR. Falls in hospital settings: a longitudinal study. *Rev. Latino-Am. Enfermagem* 2012;20:597-603.
9. Pasa TS, De Souza Magnago TSB, De Souza Urbanetto J, Baratto MAM, Moraes BX, Carollo JB. Risk assessment and incidence of falls in adult hospitalized patients. *Rev Lat Am Enfermagem* 2017;25:e2862.
10. Luzia MF, Victor MAG, Lucena AF. Nursing Diagnosis Risk for falls: prevalence and clinical profile of hospitalized patients. *Rev. Latino-Am. Enfermagem* 2014;22:262-68.
11. Wang L, Xue Z, Ezeana CF, Puppala M, Chen S, Danforth RL, et al. Preventing inpatient falls with injuries using integrative machine learning prediction: a cohort study. *npj Digital Medicine* 2019;2.
12. Morse J M, Morse RM, Tylko SJ. Development of a scale to identify the fall-prone patient. *Can J Aging* 1989;89:366-77.
13. Byrd EM, Brown CJ, Miltner RS. Hospital falls. In: Agrawal, A, Bhatt J (eds) *Patient Safety* Springer, Cham 2023;199-213.
14. Kobayashi K, Imagama S, Ando K, Inagaki Y, Suzuki Y, Nishida Y, et al. Analysis of falls that caused serious events in hospitalized patients. *Geriatr Gerontol Int* 2017;17:2403-6.
15. Montejano-Lozoya R, Miguel-Montoya I, Gea-Caballero V, Mármol-López MI, Ruiz-Hontangas A, Orti-Lucas R. Impact of Nurses' Intervention in the Prevention of Falls in Hospitalized Patients. *Int J Environ Res Public Health*. 2020;17:6048.
16. Najafpour Z, Godarzi Z, Mohammad Arab M, Yaseri M. Risk Factors for Falls in Hospital In-Patients: A Prospective Nested Case Control Study. *Int J Health Policy Manag* 2019;8:300-6.
17. Edwards SA, Ioannou A, Carin-Levy G, Cowey E, Brady M, Morton S, et al. Properties of Pain Assessment Tools for Use in People Living With Stroke: Systematic Review. *Front Neurol* 2020;11:792.
18. Arkelin D. Using SPSS to understand research and data analysis. *Psych Curr Mat* 1 2014.
19. Cox J, Thomas-Hawkins C, Pajarillo E, DeGennaro S, Cadmus E, Martinez M. Factors associated with falls in hospitalized adult patients. *Appl Nurs Res* 2015;28:78-82.
20. Kobayashi K, Ando K, Inagaki Y, Suzuki Y, Nagao Y, Ishiguro N, et al. Characteristics of falls in orthopedic patients during hospitalization. *Nagoya J Med Sci* 2018;80:341-9.
21. Heng H, Jazayeri D, Shaw L, Kiegaldie D, Hill AM, Morris ME. Hospital falls prevention with patient education: a scoping review. *BMC Geriatrics* 2020;20:140.
22. Sylaja PN, Pandian JD, Kaul S, Srivastava MVP, Khurana D, Schwamm LH, et al. Ischemic stroke profile, risk factors, and outcomes in India. *Stroke* 2018;49:219-22.
23. Schneider AT, Kissela B, Woo D, Kleindorfer D, Alwell K, Miller R, et al. Ischemic stroke subtypes: a population-based study of incidence rates among blacks and whites. *Stroke* 2004;35:1552-6.
24. Feigin VL, Lawes CM, Bennett DA, Barker-Collo SL, Parag V. Worldwide stroke incidence and early case fatality reported in 56 population-based studies: a systematic review. *Lancet Neurol* 2009;8:355-69.
25. Tsai CF, Thomas B, Sudlow CL. Epidemiology of stroke and its subtypes in Chinese vs white populations: a systematic review. *Neurology* 2013;81:264-72.
26. Rocha HB, Samuel RCF, Lahti LA, Azevedo RC, Creutzberg M, Gustavo AS, et al. Avaliação do risco de quedas em adultos hospitalizados conforme a Morse Fall Scale traduzida para a língua portuguesa. *Rev Graduação* 2013;6:1-7.
27. Albuquerque NLS, Sisando MJA, Sampaio SPC Filho, Moraes HCC, Lopes MVO, Araújo TL. Fatores de risco para quedas em pacientes hospitalizados com cardiopatia isquêmica. *Rev Rene* 2013;14:158-68.
28. Edwards SA, Ioannou A, Carin-Levy G, Cowey E, Brady M, Morton S, et al. Properties of Pain Assessment Tools for Use in People Living With Stroke: Systematic Review. *Front Neurol* 2020;11:792.