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Original Article

Reliability, Sensitivity, and Specificity of the Morse Fall Scale: A Hospitalized Population in Iran

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Abstract

Background and Objectives: One of the important indicators of patient safety and quality of hospital care is the patient's fall. Patient falls are among the most crucial issues in the field of Never Events that will affect the health-care systems, and it is necessary to be considered to improve the safety of hospitalized patients. The present study was conducted to investigate the reliability, sensitivity, and specificity of the Morse Fall Scale (MFS) in Iran. **Methods:** In this prospective observational study, the reliability of the MFS was investigated through the inter-rater reliability. The researcher as the first evaluator and an experienced nurse as the second evaluator screened 180 patients in two educational hospitals in Tehran, Iran, between March and May 2021, using the access method with a MFS. The percentage of agreement of the evaluators was assessed using the Cohen's kappa coefficient, and sensitivity and specificity were assessed using the receiver operating characteristic curve. **Results:** The results showed that the percentages of agreement between the two assessors in the patient fall history index, in the index of secondary diagnoses, in the index of assistive devices, in the index of IV therapy and heparin lock, in the index of gait/transferring, and in the index of mental status were 0.869, 0.916, 0.871, 1.00, 0.898, and 0.815, respectively. The MFS reliability was obtained by an interclass correlation coefficient of 0.825, sensitivity of 66.7, and specificity of 81.6. **Conclusion:** The reliability, sensitivity, and specificity of the Morse scale are relatively favorable. Therefore, it is suggested that a patient fall screening scale be designed to measure all dimensions related to the correct assessment of the patient in terms of clinical conditions and nonclinical factors related to patient fall.

Keywords: Fall, Morse, prediction, prevention, reliability, safety, sensitivity, specificity

Introduction

Patient safety has several indicators; one important indicator affecting the quality of care is the patient fall in hospitals, which is very likely to occur in all age groups and in all clinical wards.[1,2] According to the World Health Organization, a fall is an event that results in an unintentional fall to the ground or to a lower level. The National Database of Nursing Quality Indicators and Morris and Isaacs (1980) also define fall as unexpected events in which the patient falls to the ground, which can be with or without injury.[3-5] Patient falls in the hospital are common and one of the concerns of patients, family, and health-care system[6,7] and among the issues that are highly emphasized in the topic Never Event.[8] Never Event includes 28 reportable events that can be divided into 7 general

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categories: surgical or procedural events, device-related events, patient protection events, care management events, environmental events, radiological events, and criminal events. Patient fall prevention is one of the patient protection events.[9] Patient assessment in terms of falls is based on the fact that falling is the most common side effect of the patient in the hospital environment. It is known to be important for the process of treatment and care of the patient.[10]

Statistics show that a significant percentage of patients in facing the health systems, especially in hospitals, suffer from complications and injuries caused by the services, and a problem is added to their initial problems. In the meantime, falls are a serious problem for hospitalized patients.[11] 2%–15% of hospitalized patients experience falls at least once. Approximately 30% of falls are associated with injury, and 4%–6% lead to serious injuries such as bruising, severe soft-tissue damage, bone and hematoma fractures, concussions, or even death.[12-14] The British National Health Service estimates that around 15 million pounds a year will be spent on hospital costs as a result of falls (92,000 pounds per year for an 800-bed hospital).[15] In addition to the Morse Fall Scale (MFS), various scales such as the Downton scale, Thomas Risk Assessment (STRATIFY), Tinetti test, the Conley scale, Hendrich Fall Risk Model (HFRM), and its later version HFRM II are available to screen patients for falls.[16-22] It has been shown that the performance of different scales predicting the patient fall varies significantly depending on the population and environment,[1] and since the fall of the patient, in addition to the damage it causes to the patient, also causes a heavy workload for the medical staff, so the priority of the hospitals should be the effective implementation of fall prevention programs.[18,23] In general, the issue of patient safety is one of the most crucial issues of health systems and is an important threat to the ability of health services to provide care; hence, anticipation, prevention, and providing the necessary equipment for an effective response are vital to reduce deaths, injuries, disability, and the burden of these events.

In Iran, due to the implementation of accreditation plan in hospitals across the country, patient safety, especially to prevent the patient from falling, has received special attention.[24] At present, in all Iranian hospitals, the Morse Fall Risk Assessment Scale is used for patients, while the validity of the Morse scale has been investigated just in a study aimed at examining the fall and its characteristics in patients admitted to hospitals affiliated to Tehran University of Medical Sciences in 2016.[25] The reliability of a scale actually examines the stability of a scale,[26] the reliability of the MFS has been studied in the population of different countries, including China, Lebanon, and Portugal, but it is important to note that the appropriate cutoff point as well as the sensitivity and specificity of the Morse scale were different.[27-29] These differences indicate the existing gap and the need to study the psychometric properties of this instrument in our country; these differences can be attributed to the health services available in the countries and research samples.The reliability of the Morse scale in the population of Iran was not studied so far. Due to the implementation of the Never Event in Iranian hospitals and as the fall injury is the top among all events, it was necessary then to evaluate the reliability of the Morse scale. Therefore, the purpose of this study was to determine the reliability, sensitivity, and specificity of the Morse Fall Risk Assessment Scale in the internal medicine and surgical wards of the hospital for future prevention.

Methods

In a descriptive cross-sectional study, according to the sample size formula) $n = \left(\frac{\left(z_{1-\frac{\alpha}{2}}\right)^2 \times p(1-p)}{d^2}\right)$,[30] the average prevalence of 13%,[31,32] and the first type error of 5%, the sample size of 180 patients was estimated. The patients were selected from eight internal medicine and surgery wards of two educational hospitals in Tehran, Iran, from March to May 2021. Internal medicine and surgery wards in any hospital are among the dynamic and active wards, where the patients with various diseases are admitted. Sampling was performed using the access method. The Morse scale, which was translated by the Ministry of Health of Iran and distributed to all hospitals in Iran, was completed using a demographic questionnaire for the patients. Inclusion criteria were age over 18 years and willingness to participate in the study. Exclusion criteria were the patient's unwillingness to answer questions and evaluation, patient transfer to the intensive care ward, and patient death.

First, the researcher (first author) as the first evaluator held a meeting with the second evaluator regarding the purpose of studying and reviewing how the Morse scale is scored. Two evaluators, with more than 15 years of nursing experience in the field of patient care, completed the scale by observing and interviewing eligible patients or their companions, in case of cognitive deficits or temporary lack of consciousness. The second evaluator performed the evaluation with the Morse scale 1 h after the first evaluator. Demographic data including age, gender, marital status, education, and occupation were collected. The Morse Fall Assessment Scale with six items (history of falls, secondary diagnosis, mobility aids, IV therapy and heparin lock, gait and transferring pattern, and brain status) was questioned by the researchers. The index of each item is presented in Table 1. How patients are classified after a fall risk assessment is shown in Table 2.

To observe the ethical issues of the research, after obtaining the code of ethics with ID number IR.SBMU.PHNS.REC.1399.202, the main researcher obtained the consent of the research units to participate in the research by introducing himself and explaining the goals and the way of conducting the research to the relevant units and individuals under research. The researcher emphasized to the research units about keeping the obtained information confidential and assured that they can benefit from the research results if they wish.

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To obtain the reliability of the MFS, the obtained data were analyzed by the SPSS version 21 (IBM Corporation, New York, NY, United States) software. Cohen's kappa coefficient was used to determine the percentage of consensus between the two evaluators. The ICC value is 0, and the closer it is to one, the higher the scale reliability.[26] The minimum acceptable reliability was assumed to be 0.7. To determine the sensitivity, specificity, and cutoff point, the researcher examined all patients who participated in the evaluation for falls during hospitalization. Of course, the researcher did not interfere in the process of patient care and safety and only followed the patients. To determine the appropriate sensitivity, characteristic, and cutoff point, their values can be obtained by plotting the receiver operating characteristic (ROC) curve.[33] A ROC curve is a graphic scheme that is created, using the actual positive rate (sensitivity) on the X-axis and the false positive rate (1 characteristic) on the Y-axis at different thresholds (different cutoff points). Based on a conventional classification system, the area under the ROC curve can be classified and interpreted as follows: excellent = 90–100, good = 80–90, relatively good = 70–80, weak = 60–70, and useless = 50–60. In general, if the test is able to detect accurately, the ROC curve above the square diameter will be closer to the ideal state of area 1.[33-35] For this purpose, to draw the ROC curve and to determine the best cutoff point and calculate the sensitivity and specificity, the data was reentered and statistically analyzed.

Table 1: Morse Fall Scale items

Item	Scale
1. History of falling; immediate or within 3 months	
No	0
Yes	25
2. Secondary diagnosis	
No	0
Yes	15
3. Ambulatory aid	
Bed rest/nurse assist	0
Crutches/cane/walker	15
Furniture	30
4. IV/Heparin lock	
No	0
Yes	20
5. Gait/transferring	
Normal/bed rest/immobile	0
Weak	10
Impaired	20
6. Mental status	
Oriented to own ability	0
Forgets limitations	15

IV: Intravenous therapy/Intravenous Line

Table 2: Risk levels of the Morse Fall Scale

Risk level	MFS score	Action
No risk	0-24	Good basic nursing care
Low risk	25-50	Implement standard fall prevention interventions
High risk	≥51	Implement high-risk fall prevention interventions

MFS: Morse Fall Scale

Results

In the present study, among 180 hospitalized patients who were evaluated, 98 (52.8%) were female and 85 (46.7%) were male and their age range was between 18 and 90 years. The results showed that the percentage of agreement between the two assessors in the patient fall history index was 0.869, in the index of secondary diagnoses was 0.916, in the index of assistive devices was 0.871, in the index of IV therapy and heparin lock was 1.00, in the index of gait/transferring was 0.898, and in the index of mental status was 0.815 [Table 3]. The reliability of the scores given by the evaluators showed that the interclass correlation coefficient (ICC) is 0.825 and is in a very good range [Table 4]. While the researcher was following the patients in question, three falls (two male patients aged 27 and 66 years and one female patient aged 71 years) were recorded. To determine the sensitivity and specificity of the Morse scale in drawing the ROC curve [Figure 1], the area under the curve (AUC) for the Morse scale was 0.766 (95% confidence interval [CI]: 0.512–1.000) in this study [Table 5]. According to the coordinate table, the Morse scale had a cutoff of 47.50, a sensitivity of 66.7, and a specificity of 81.6 [Table 6].

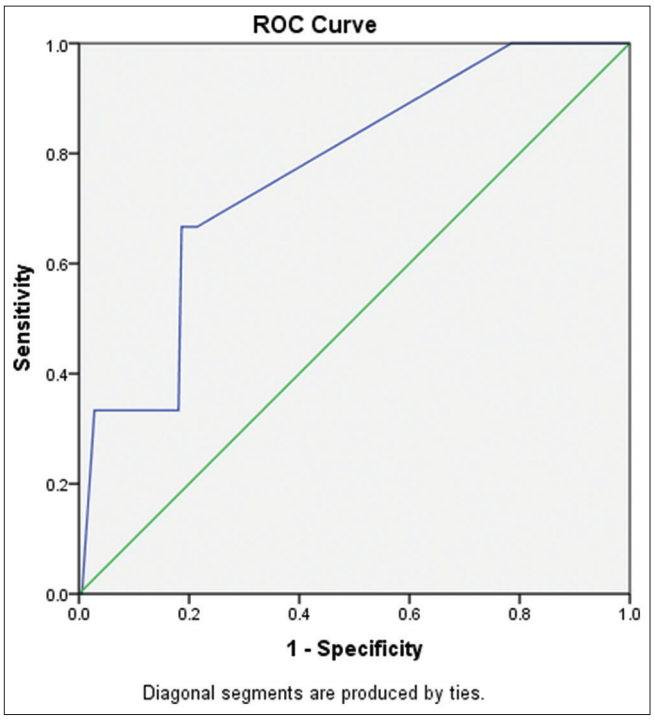

Figure 1: ROC curve to investigate the sensitivity and specificity of the Morse Fall Scale in hospitalized patients in Iran. ROC: Receiver operating characteristic

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Table 3: Percentage of agreement between the two evaluators to assess the reliability of the Morse Fall Scale in hospitalized patients in Iran

Scale	Measure of agreement kappa			
	Value	Asymptotic SE[a]	Approximate *T*	Approximate significant
History of falling	0.869	0.091	11.764	0.000
Secondary diagnosis	0.916	0.037	12.303	0.000
Ambulatory aid	0.871	0.046	15.788	0.000
IV/heparin lock	1.000	0.000	13.416	0.000
Gait/transferring	0.898	0.040	14.682	0.000
Mental status	0.815	0.104	10.953	0.000

SE: Standard error, IV: Intravenous therapy/Intravenous Line. [a]Not assuming the null hypothesis

Table 4: Intraclass correlation coefficient of evaluators for Morse Fall Scale in hospitalized patients in Iran

	ICC[b]	95% CI		*F* test with true value 0			
		Lower bound	Upper bound	Value	df1	df2	Significant
Single measures	0.282[a]	0.233	0.339	5.707	179	1969	0.000
Average measures	0.825[c]	0.784	0.860	5.707	179	1969	0.000

ICC: Intraclass correlation, CI: Confidence Interval. [b]Type C intraclass correlation coefficients using a consistency definition-the between-measure variance is excluded from the denominator variance

Table 5: The area below the receiver operating characteristic curve to assess the sensitivity and specificity of the Morse Fall Scale for hospitalized patients in Iran

Area	SE	Asymptotic significant	Asymptotic 95% CI	
			Lower bound	Upper bound
0.766	0.130	0.114	0.512	1.000

CI: Confidence interval, SE: Standard error

Table 6: Cutoff, sensitivity, and specificity of the Morse Fall Scale for hospitalized patients in Iran

Positive if greater than or equal to	Sensitivity	1 - Specificity
42.50	66.7	20.9
47.50	66.7	81.6
55.00	33.3	81.1

Discussion

The present study aimed to determine the reliability, sensitivity, and specificity of the Morse Fall Risk Assessment Scale in the internal and surgical wards of hospitals. Findings of this study showed that the percentage of agreement between the two assessors regarding the indicators of patient fall history, secondary diagnoses, assistive devices, mental status, and gait/transferring was over 80% and the percentage of agreement between the two assessors in IV treatment index and heparin lock was 100%. A previous study examining the compatibility of the Morse scale in Portugal showed that in all indicators, the percentage of evaluators' agreement was almost excellent (0.819–1.00), with the exception of gait/transferring, where the percentage of evaluators' agreement was 0.798.[29] The inter-rater reliability of the Morse scale in the present study showed that the ICC has a good rating. Furthermore, a study conducted in China to evaluate the Morse scale showed that the reliability of the Morse scale was high (95% CI: 0.98–0.99) with an ICC of 0.98.[28] In another study, the overall evaluation among evaluators showed that the ICC was 0.982, indicating a high percentage of agreement between the evaluators.[29] As shown, the percentage of agreement of the Morse scale evaluators on the scale indicators in various studies is different and there is a need to have a scale that accurately predicts the patient's fall in the hospital, so that, in a study that also aimed to determine the accuracy of various scales such as Morse, STRATIFY, and the Hendrich II Fall Risk Model for diagnosing the risk of falls and predicting falls in acute patients hospitalized in 2013, the results of the meta-analysis of the study revealed that the STRATIFY tool had a higher diagnostic validity with odds ratio (OR) value of 7.640 (95% CI: 4.862–12.007) vs. 5.068 (95% CI: 3.747–6.857) for Morse and 3.362 (95% CI: 2.107–5.364) for Hendrich II.[1] Of course, the performance of these scales and their actual adaptation to different populations and environments is different, and it is necessary to test the performance of the scales before implementation.

In the present study, after evaluation, the AUC was reported to be 76.0, which indicates that it is in a favorable area. In a study that analyzed the predictive ability of fall risk with the translated Brazilian version, the area under the curve was 0.84 (CI: 95%: 0.820-0.876) at the cut-off of 44.78, with a sensitivity of 95% and a specificity of 64%.[36] In this study, it was shown that the sensitivity and specificity of the Morse scale at a cutoff of 47.50 were 66.7 and 81.6, respectively. A review study aimed at investigating the research studies from 1989 to 2016 on the predictive value of the Morse scale among the hospitalized patients showed that the sensitivity values ranged from 31%

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to 98% and the specificity values ranged from 8% to 98%.[37] Furthermore, in a study that examined the Morse's predictive power among the high-risk and low-risk patients, it was found that in a cutoff of 25, sensitivity was 98% (high sensitivity), but specificity was 8% (very low specificity). Patients at a high risk of falls have not been reported to have fallen due to well-implemented preventive strategies in the hospital.[38] In a study examining fall risk predictors and reliability through inter-rater reliability in 2003, the MFS at a cutoff of 25 had a high sensitivity (88%) and specificity (48.3%).[39] In general, patient falls are a major threat in the hospital, and since it is a multidimensional phenomenon and is influenced by individual and environmental factors, there is a need for both prediction and fall prevention to be given special attention by health officials and caregivers to be able to control most aspects and factors affecting the fall and reduce the rate of fall.

One of the strengths of the present study is that it has been conducted for the first time in Iran. One of the limitations of the present study was that sampling was conducted during the coronavirus pandemic, and we used just two centers for this purpose and it was not possible for the researcher to treat all patients simultaneously. Another limitation was the lack of falling risk assessment in patients of single specialized clinical units, but since internal medicine and general surgery are among the most important departments in hospitals, it was believed that by including the two wards, information bias will be minimized.

Conclusion

The findings of the present study reveal that the predictive power and reproducibility of the Morse scale are relatively desirable; thus, there is a need to design a scale that can optimally and comprehensively measure all aspects of clinical conditions and factors among the patients affecting the fall probability.

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Conflicts of interest

There are no conflicts of interest.

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