Original article

Falls in hospitalized elderly patients receiving enteral nutrition: a cohort study

Quedas em pessoas idosas hospitalizadas com nutrição enteral: estudo de coorte

Caídas en ancianos hospitalizados que reciben nutrición enteral: un estudio de cohorte

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Abstract

Objective: to identify the incidence of falls in elderly people receiving enteral nutrition and verify the association with demographic and clinical-nutritional variables and with the SAK Fall Risk Scale. **Method:** prospective cohort study, conducted in a hospital in southern Brazil from August 2022 to May 2023. Descriptive and analytical statistics were used. **Results:** 99 elderly people with a median age of 71 years were evaluated. The incidence of falls was 8.1%; 36.4% had moderate risk, and 35.4% had high risk of falling; 50.5% were malnourished. The degree of injury was classified as mild; all were discharged from the hospital, and 94% had prolonged hospitalization. Inadequate calf circumference was identified in a higher percentage among individuals who fell (75% versus 63.2%; p=0.032). There was no significant difference between the other variables. **Conclusion:** The low incidence of falls reinforces protocols aimed at patient safety.
Descriptors: Accidental Falls; Aged; Nurses Improving Care for Health System Elders; Nutritional Status; Enteral Nutrition

Resumo

Objetivo: identificar a incidência de quedas em pessoas idosas com nutrição enteral e verificar a associação com variáveis demográficas, clínico-nutricionais e com a Escala de Risco de Quedas SAK. **Método:** estudo de coorte, prospectivo, realizado em hospital do Sul do Brasil, de agosto de 2022 a maio de 2023.Utilizou-se estatística descritiva e analítica. **Resultados:** avaliaram-se 99 pessoas idosas com mediana de 71 anos de idade. A incidência de quedas foi 8,1%; 36,4% tinham moderado e 35,4% alto risco de queda; 50,5% apresentavam desnutrição. O grau de dano do evento foi até o leve; todos receberam alta hospitalar e 94% tiveram internação prolongada. Circunferência da panturrilha inadequada foi identificada em maior percentual entre os indivíduos que apresentaram queda (75% *versus* 63,2%; p=0,032). Não houve diferença

significativa para as outras variáveis. **Conclusão:** a incidência baixa de quedas reforça os protocolos voltados para a segurança do paciente.
Descritores: Acidentes por Quedas; Idoso; Cuidado de Enfermagem ao Idoso Hospitalizado; Estado Nutricional; Nutrição Enteral

Resumen

Objetivo: identificar la incidencia de caídas en ancianos que reciben nutrición enteral y verificar su asociación con variables demográficas, clínico-nutricionales y con la Escala de Riesgo de Caídas SAK. **Método:** se realizó un estudio de cohorte prospectivo en un hospital de la Región Sur de Brasil, entre agosto de 2022 y mayo de 2023. Se utilizó estadística descriptiva y analítica. **Resultados:** Se evaluaron 99 ancianos con una mediana de edad de 71 años. La incidencia de caídas fue del 8,1%; el 36,4% presentó un riesgo moderado y el 35,4% un riesgo alto de caídas; el 50,5% presentó desnutrición. El grado de daño causado por el evento se clasificó como leve; todos fueron dados de alta del hospital y el 94% tuvo una hospitalización prolongada. Se identificó una circunferencia de pantorrilla inadecuada en un mayor porcentaje entre los individuos que experimentaron caídas (75% versus 63,2%; p = 0,032). No se observaron diferencias significativas entre las demás variables. **Conclusión:** la baja incidencia de caídas refuerza los protocolos de seguridad del paciente
Descriptores: Accidentes por Caídas; Anciano; Nurses Improving Care for Health System Elders; Estado Nutricional; Nutrición Enteral

Introduction

Falls in hospitalized patients are a major public health problem, as they result in physical injuries, secondary complications, impairment of activities of daily living, and increased length of stay and hospitalization costs.[1] Although falls are preventable, it is estimated that more than 80% of fall-related deaths occur in low- and middle-income countries and are more common among older adults.[1]

A retrospective observational cohort study conducted in a hospital in Madrid pointed to a higher incidence of falls in elderly people admitted to clinical units (1.61 falls/1,000 patients/day). Of these injuries, 63.6% did not result in injury, but a direct relationship was identified between the increase in the number of days of hospitalization and the occurrence of falls.[2] Among patients who had a fall with injury, most had minor injuries. Falls in older adults are the second leading cause of injury-related mortality worldwide.[3] Reducing these events requires efforts to coordinate social policies at all levels of management and recognition of risk factors.[4-5]

Among the factors that can contribute to falls, malnutrition stands out, which, among the elderly, actually accentuates muscle loss and decreases strength, affecting balance maintenance.[6] Different studies[7-8] have addressed the higher frequency of falls

in this population, since impaired mobility, mental confusion, agitation, delirium, history of falls, and polypharmacy are factors that can be exacerbated in older individuals.

A study conducted at a tertiary hospital in Seoul with 15,066 patients showed that low Body Mass Index (BMI) is associated with the risk of falls. In this study, approximately 70% of the sample aged 65 years or older had a moderate or high risk of falls.[9] The impact of low BMI on the risk of falls may be related to sarcopenia, which aggravates the decline in muscle and physical function.[6]

To optimize nutritional status, the use of a Nasoenteral Tube (NTE) is an important component in the nutritional recovery of elderly people.[10] In this sense, the aging process associated with multiple comorbidities, reduced functional capacity, and mobility limitations reflects the clinical profile of patients.[5,7-8]

In this way, hospitals improve patient care by adopting specific models for predicting the risk of falls as a means of mitigating the risks and potential harm resulting from falls in the hospital environment. To identify such risks, the Severo-Almeida-Kuchenbecker Fall Risk Scale (SAK), validated in Brazil and implemented in a large institution in the south of the country, was standardized to assist in fall prevention. The SAK assesses seven items, with accuracy and easy application at the bedside.[11-12]

Thus, this research with the hospitalized elderly population, commonly underweight, is justified, since malnutrition can be an important trigger for falls. The use of classification instruments is necessary to identify patients at risk of falls to prevent and reduce them in hospital settings.[13] In this context, this study is pioneering in assessing the relationship between nutritional status and the SAK Fall Risk Scale, as well as the occurrence of falls among hospitalized elderly people.

Thus, the objectives of this study are to identify the incidence of falls in elderly people receiving enteral nutrition and to verify the association with demographic and clinical-nutritional variables and with the SAK Fall Risk Scale.

Method

Prospective, analytical-descriptive cohort study with a quantitative data approach, conducted from August 2022 to May 2023, based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines and

conducted at a private university hospital in southern Brazil. The institution, accredited by the Joint Commission International (JCI), has 930 beds and primarily serves patients from the Unified Health System (SUS), in addition to providing care to patients with private health insurance and private patients. It has 60 specialties for the diagnosis and treatment of different pathologies.

The study was conducted in four clinical units and four surgical units, both intended for adult SUS patients. The four clinical units included admitting adult patients in the specialties of Internal Medicine, Geriatrics, Oncology, Neurology, Cardiology, and Infectious Diseases, with a total of 169 beds. The four surgical units are intended for patients undergoing digestive tract, general, thoracic, vascular, coloproctology, neurosurgery, orthopedics, and traumatology surgery, with a total of 159 beds.

Patients aged 60 years or older who were admitted to the above-mentioned units and receiving enteral nutrition through NTE were included. The following exclusion criteria were adopted: patients receiving enteral nutrition via ostomies; patients with precautions for contact with multidrug-resistant germs; patients in isolation as a precaution due to respiratory diseases transmitted by aerosols or droplets (e.g., tuberculosis or coronavirus-19); and patients with mental confusion who were unaccompanied. It was a convenience sample, whose sample size was calculated to estimate the incidence of falls with a maximum range for the confidence interval of 10% and a confidence level of 95%. The online version of the PSS Health tool (PSS Health)[14] and the Wald method to estimate the confidence interval of the expected proportion of the risk of falling of 59.6%.[15] The sample size was set at 85 subjects, and with the addition of 10% for possible losses and refusals, the calculated sample size[16] was 94.

The patients included were followed up individually from the date they started using NTE until the date of discharge or death, which was considered the follow-up period of the study. The variables investigated were: gender (female/male); age (years); Charlson score (zero: no comorbidities, ≥ 1 to ≤ 2: low comorbidity index/low mortality risk, and > 2: high comorbidity index/high mortality risk)[17] comorbidities; hospitalization (clinical/surgical); indications for NTE use; BMI classification;[18] calf circumference, Nursing Diagnosis (ND) Risk of Falls, and SAK Fall Risk Scale.

The participants' Calf Circumference (CC) was measured at the bedside by one of the researchers, who had been previously trained by the senior author, using a 1.5-meter inelastic tape measure with 1 mm precision. The CC measurement was recorded in a spreadsheet prepared by the authors. Data on the characteristics of the participants were obtained from the medical records of each patient included in the study and were recorded in a Google Forms form. In this form, clinical and demographic variables, nutritional status, BMI classification, CC, Fall Risk ND, and SAK Fall Risk Scale score were recorded.

BMI was calculated using weight/height^2 and classified the nutritional status of elderly individuals (aged ≥60 years) according to the following scores: BMI ≤22.0 as underweight, BMI >22.0 and <27.0 as normal weight, and BMI ≥27 as overweight.[18] At the institution where the study was conducted, weight and height are measured at the time of admission by the nursing staff (nurse or nursing technician). Calf circumference was considered adequate according to the cutoff values of 31 cm for men and women, as recommended by the World Health Organization (WHO).[19]

The scoring and conceptual definition of each variable of the SAK Fall Risk Scale are described below (Table 1). The final SAK score results in three classifications: SAK ≤ 6.0 points represents low risk; SAK between 6.0 and 10.0 points represents moderate risk, and SAK ≥ 10.5 points is considered high risk for falls.[12,20] The SAK is performed by the nurse at the time of hospital admission, twice a week, when the patient's clinical condition changes, after a fall, when transferring units, and at discharge. This study used SAK data from the time of patient admission, which were collected from each patient's medical record. At the institution surveyed, falls are reported by nurses in the patient's electronic medical record and are recorded alongside care scores.

Chart 1 – Definitions and scoring of the SAK Fall Risk Scale

Variables	Points*	Conceptual definition
Disorientation/confusion	YES=5 NO=0	Mental disorder characterized by an inability to think clearly.
Frequent urination	YES=5 NO=0	Frequent need to use the bathroom.
Limited mobility	YES=4 NO=0	Limited ability to walk.
Number of medications administered (up to 24 hours)	Number of different medications X1	Administration of medications within 24 hours that increase the possibility of falls.
Previous fall	YES=1 NO=0	Had a fall in the previous three months or during hospitalization.
No companion	YES=0.5 NO=0	Does not have a caregiver during the application of the scale.
Postoperative	YES=0.5 NO=0	Surgery performed during current hospitalization.

Source: Severo et al. (2019);[12] Severo et al. (2021).[20] Caption: (*) The sum of the points for each variable generates the scale score

The primary outcome measured was the occurrence of in-hospital falls, and the secondary outcomes were: the degree of injury resulting from the event; prolonged hospitalization (greater than or equal to eight days), discharge, and/or death of patients, as recorded in the patient's electronic medical record and recorded in a Microsoft Excel spreadsheet.

The degree of injury was classified as: no injury; minor injury (mild symptoms, loss of function, minimal or moderate injuries of short duration and requiring only minimal intervention); moderate injury (symptomatic patient requiring intervention, e.g., therapeutic procedure or additional treatment, increased length of hospital stay, permanent or long-term damage or loss of function) and severe damage (symptomatic patient, need for life support intervention or major clinical/surgical intervention, causing decreased life expectancy, with severe damage or permanent or long-term loss of function, or associated death).[21]

A descriptive analysis of the data was performed. The Kolmogorov-Smirnov test was used to assess data distribution (continuous variables). Continuous variables were described as mean and standard deviation when they were normally distributed, or median and interquartile range when they were asymmetrically distributed. Categorical variables were expressed as absolute numbers and percentages.

The risk of falling, according to the SAK score, was stratified into three categories: low, moderate, and high risk. The incidence of falls was measured by the absolute number and percentage of falls during the study period for clinical and surgical patients in the sample. For comparisons between patients who did or did not experience a fall, in relation to demographic, clinical, and nutritional status characteristics, Student's t-test or Mann-Whitney test (if continuous variable) was used, or Pearson's chi-square test or Fisher's exact test (if categorical variable) was applied. A two-tailed p-value <0.05 was considered statistically significant, in accordance with the 95% confidence interval. Microsoft Excel and Statistical Package for the Social Sciences (SPSS) version 20.0 statistical programs were used for data analysis.

The Free and Informed Consent Term (FICT) was applied to all participants who, upon being invited, received information about the study's objectives and the implications of their participation. The research was conducted in accordance with Resolutions No. 466/2012, No. 510/2016, and No. 580/2018 of the Ministry of Health and approved on July 28, 2022, by the Research and Ethics Committee (REC) of the institution hosting the study under opinion CAEE No. 60640422.6.0000.5327.

Results

Among the 194 participants who were potentially eligible for the study, 99 participants were ultimately included. The others were excluded because they did not meet the following eligibility criteria, as shown in Figure 1:

Figure 1 – Study flow diagram. Porto Alegre (RS), Brazil, 2022-2023.
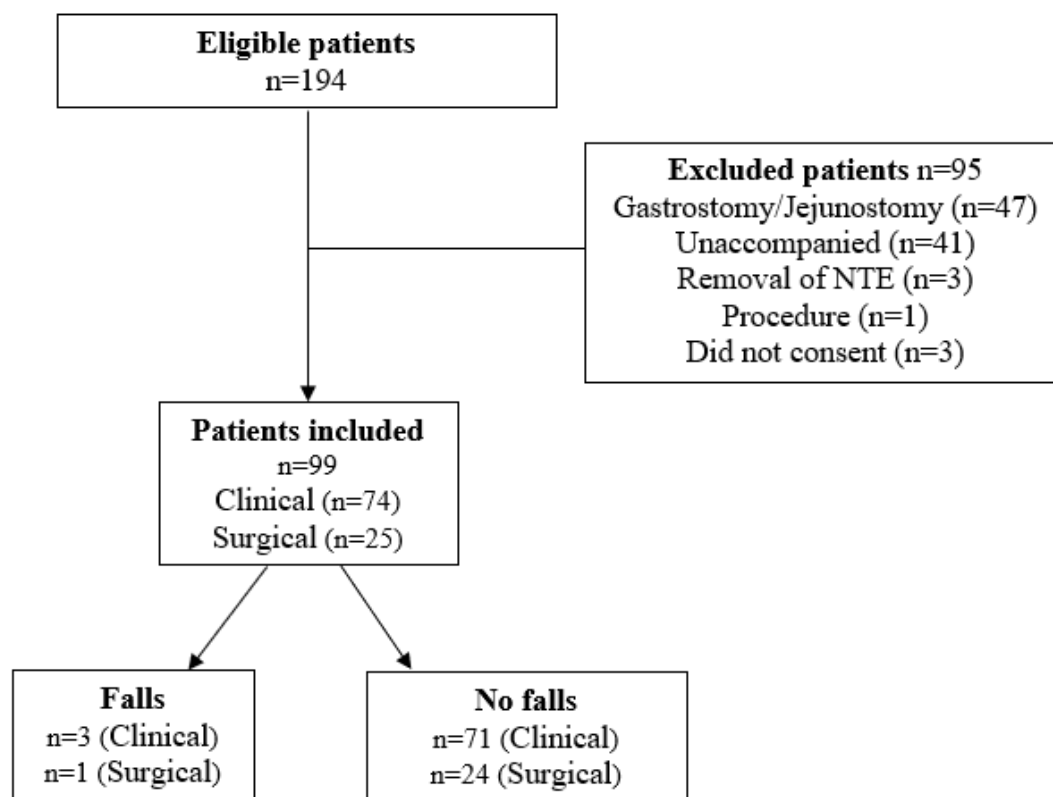
At the end of the study, one surgical patient experienced a fall, while three clinical patients experienced the outcome, resulting in an incidence of 4.1% and 4.0%, respectively. The total incidence in the sample was 8.1%.

The median age was 71 (66-78) years, and males accounted for 53% of the sample. The most frequent comorbidity was peripheral vascular disease, followed by cerebrovascular disease and diabetes mellitus. Dysphagia was the main indication for the use of NTE. Regarding nutritional status, 50.5% of participants were malnourished (according to BMI), and 63.6% of elderly people had inadequate calf circumference measurements. Among patients who had fallen, a higher proportion of inadequate calf circumference was observed compared to the group without falls (75% versus 63.6%, p=0.03). For the other variables, there was no significant difference (Table 1).

Table 1 – Comparison between patients with and without falls, according to demographic, clinical, and nutritional variables. Porto Alegre (RS), Brazil, 2022-2023

Variable	Total n=99	Falls n=4	No falls n=95	p-value
Male gender	52 (53.0)	2 (50.0)	50 (52.6)	0.91
Age (years)*	71 (66-78)	69 (62.8-73.8)	71 (66-78)	0.88
Charlson score*	3 (2-4)	2 (2-3)	3 (2-4)	0.24
Comorbidities				
Peripheral vascular disease	70 (70.7)	3 (75.0)	67 (70.5)	0.19
Cerebrovascular disease	42 (42.4)	3 (75.0)	39 (41.0)	1.00
Diabetes mellitus	38 (38.4)	2 (50.0)	36 (37.9)	0.70
Tumor	32 (32.3)	1 (25.0)	31 (32.6)	0.42
Dementia	17 (17.2)	3 (75.0)	14 (14.7)	0.09
Chronic obstructive pulmonary disease	14 (14.1)	-	14 (14.7)	0.58
Congestive heart failure	6 (6.0)	1 (25.0)	5 (5.3)	0.36
Acute myocardial infarction	5 (5.0)	-	5 (5.3)	1.00
Kidney disease	3 (3.0)	-	3 (3.1)	1.00
Acquired immunodeficiency syndrome	2 (2.0)	-	2 (2.1)	1.00
Hospitalization				
Clinic	74 (74.7)	3 (75.0)	71 (74.7)	0.99
Surgical	25 (25.3)	1 (25.0)	24 (25.3)	
Indications for use of NTE				0.91
Dysphagia	60 (60.6)	2 (50.0)	58 (61.1)	
Neoplasia	18 (18.2)	1 (25.0)	17 (17.9)	
Low oral intake	7 (7.1)	1 (25.0)	6 (6.3)	
Malnutrition	5 (5.1)	-	5 (5.3)	
Delirium	2 (2.0)	-	2 (2.1)	
Postoperative	2 (2.0)	-	2 (2.1)	
Others	4 (4.0)	-	4 (4.2)	
BMI classification				0.29
Malnutrition	50 (50.5)	3 (75.0)	47 (49.5)	
Obesity	36 (36.0)	-	36 (37.9)	
Overweight/obesity	13 (13.0)	1 (25.0)	12 (12.6)	
Calf circumference				0.03
Inadequate	63 (63.6)	3 (75.0)	60 (63.2)	
Adequate	36 (36.4)	1 (25.0)	35 (36.8)	

Caption: (*) median and 25-75 percentiles; (-) Numerical data equal to zero not resulting from rounding.

Among the patients included, 28 (28.3%) had a low risk of falls, 36 (36.4%) had a moderate risk, and 35 (35.4%) had a high risk of falls during hospitalization, according to the SAK Fall Risk Scale (Figure 2). When comparing the risk of falling, according to the SAK, between patients with and without falls during hospitalization, it was observed that no patient with a fall had a low risk; 50% of patients with moderate risk and 50% of patients with high risk had a fall. However, these data did not show a statistically significant difference (p=0.43).

Figure 2 – Percentage of patients in the sample with and without falls, according to the SAK Fall Risk Scale (n=99). Porto Alegre (RS), Brazil, 2022-2023
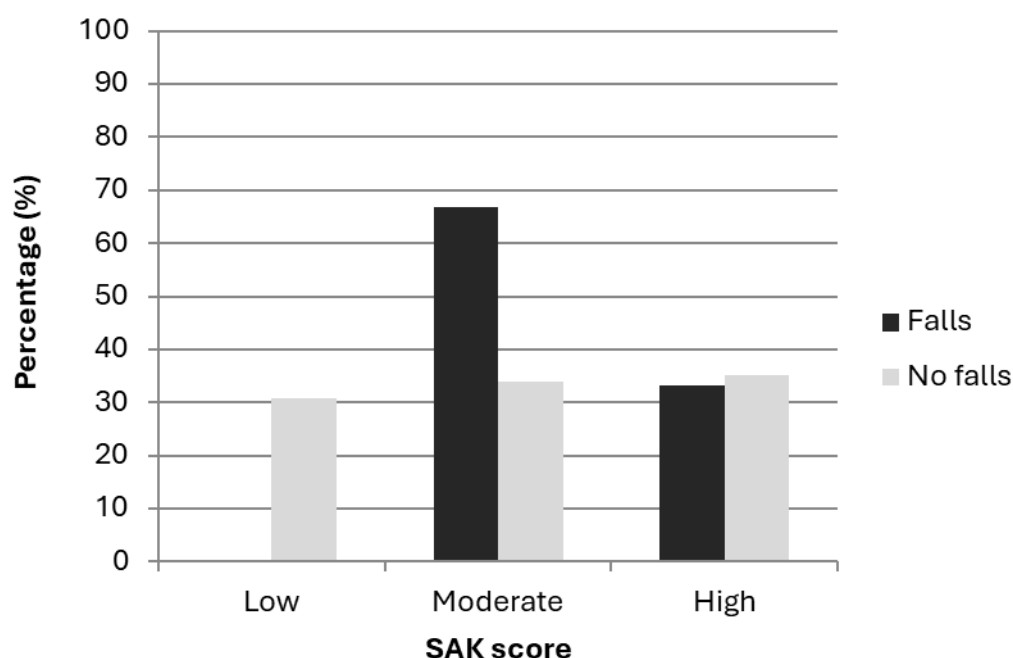
The SAK subscales showed that 65.7% of elderly people had difficulty walking; 46.5% did not have a companion; 39.3% used three to four medications in 24 hours, 42.5% used one to two, and 15.2% did not use medications; 43.4% were disoriented or confused; 24% were in the postoperative period; 4% reported a previous fall, and 2% had frequent urination. There was no significant difference between the items of the SAK subscales and the occurrence of falls.

The Fall Risk ND was identified for 65.7% of the total patients included. It was present for 100% of patients who fell during the study and in 64.2% of patients without falls (p=0.29). Among the remaining 34.3% who did not have the ND, 11 (32.4%) patients were identified as having moderate risk, and 12 (35.3%) as having high risk, according to the SAK.

The damage resulting from the event was classified as mild in one patient, and the other three patients did not suffer any damage. None of the patients who suffered a fall died within 24 hours of the event, and all were discharged from the hospital. The median length of hospital stay among patients who fell was 45 (16-70) days, and among patients who did not fall, the median was 21 (14-31) days (p=0.95). Most patients in the entire sample (94%) had a prolonged hospital stay.

Discussion

This study showed a low incidence (below 10%) of falls when compared to scientific literature from different institutions in the hospital care network.[7,22-23] This finding corroborates the fact that the institution in the field of study, accredited by the JCI, uses an institutional fall prevention protocol, with evidence-based interventions[16,24] categorized according to the patient's risk score, which contributes to greater safety.

In this study, 63.6% of elderly individuals had inadequate calf circumference. Among them, there was a higher percentage of falls. Thus, it is understood that inadequate calf circumference was the only nutritional characteristic that showed a statistically significant difference for the outcome of falls. Calf circumference has been an independent risk factor for worse outcomes[25] (mortality and prolonged hospital admission), as well as for falls among older adults.[26]

In addition, nursing interventions should be part of multidisciplinary strategies, together with maintaining or increasing body weight, to improve functional status and clinical outcomes.[10,22] There is a significant relationship between BMI and CC, which shows that CC is an important indicator of nutritional risk, associated with the risk of falls and functional disability. Furthermore, malnutrition contributes significantly to falls with greater damage.[22]

Regarding fall risk assessment, 35.4% of hospitalized elderly people were at high risk for falls, followed by 36.4% at moderate risk, as scored by the SAK. At the institution surveyed, nurses must list the ND Risk of Falls and prescribe individualized care for patients at moderate and high risk of falling. This ND was recorded for 65.7% of the patients in the sample. At the study site, care scores are computerized, and their interactive use stimulates critical thinking and clinical reasoning by nurses, which facilitates the development of a more accurate ND.[27]

Diagnostic accuracy was assessed in the medical records of 155 hospitalized patients, and the Risk of Falls ND as one of the most frequent at both admission and at hospital discharge. This data reflects the need for continuous care after discharge, including the prevention of falls at home.

Another relevant finding was the absence of statistically significant differences between variables related to nutritional status (BMI and calf circumference) for patients with moderate/high risk of falling. In a public university hospital in the interior of Espírito Santo, with 244 participants, and using the Morse Scale, it was found that 47.5% of individuals over 60 years of age (n=116) had a moderate to high risk of falling, a lower value than that observed, with lower results among the elderly in this study.[28]

The highest incidence of falls was identified in males (53%), with a median age of 71 years. Some studies[5,7,28] also reported a higher incidence of falls among the male population. This relationship is justified in the literature by the longer length of hospital stay, which increases exposure, and by the higher hospital mortality rate when compared to females. However, other studies[4-5] have pointed out that there is a higher incidence of falls in the female population, justified by osteoporosis rates and menopause-related changes, which impact hormone levels and reduce muscle mass. In addition, due to higher life expectancy, women seek more health care and therefore have a longer life expectancy, which increases their exposure to the risk of falls.

The occurrence of falls in older adults is strongly correlated with polypharmacy and the presence of multiple comorbidities, regardless of sex.[11-12] Such events should not be considered inherent or physiological to the aging process, whether in men or women. Age should be considered an important factor, as motor and cognitive issues, together with degenerative diseases and other limitations, reduce functional capacity

and increase the risk of falls in this population. These factors reiterate the clinical characteristics that, when added to the aging process, are potentiated.[23]

Hospitalized elderly patients who use gastric or enteral tubes are associated with a high number of safety incidents. The level of dependence on nursing care and age are factors that directly contribute to the occurrence of these incidents.[29] Current evidence linking malnutrition to hospital falls focuses mainly on patients who already have nutritional deficiencies prior to hospitalization.[6,24] However, it is important to note that prediction models are fragile because they do not measure the scope of the patient's nutritional condition.[24]

The main reason for the use of NTE was dysphagia, present in 60.6% of the sample, followed by neoplasms (18.2%). Neurological diseases were the main diagnosis for the use of NTE, which can lead to dysphagia, to prevent malnutrition, dehydration, and aspiration pneumonia. No significant association was identified between the risk of falling and nutritional status variables, according to BMI. A similar finding was observed in a study that investigated the correlation between the risk of falls and functional mobility associated with obesity.[15] Other studies have identified an association between polypharmacy and the risk of falls.[11-12]

Regarding the use of BMI to assess the nutritional risk of the sample, it was found that 50.5% of the elderly were malnourished. Among the factors that play a decisive role in falls and fractures, long-term malnutrition, the number of comorbidities, and advanced age stand out. Early detection of malnutrition, fall risk, and fracture risk facilitates planned interventions in the geriatric population and prevents negative outcomes, such as functional decline and institutionalization.[22]

This study has limitations related to the assessment of fall risk, which was performed based on the scale applied by the institution's nurse. Although there is standardization for its completion, it is an operator-dependent tool. Other limitations include the low incidence of falls, which may have reduced statistical power, convenience sampling, and the single-center nature of the study, which limit the generalization of the results. In addition, the classification of nutritional status using BMI,

a method that has intrinsic limitations, stands out. However, this limitation was minimized by measuring CC. Nevertheless, this study is the first to assess the association of nutritional status with the SAK Fall Risk Scale and falls among hospitalized elderly people.

Thus, this study highlights the importance of nurses taking a critical approach during physical examinations, especially when assessing the risk of falls, with calf circumference measurement recommended as a strategy for preventing this type of incident.[30] In addition, it highlights the need for a systemic assessment of patients, considering multimorbidities and their potential impacts, in order to structure the planning of preventive actions and the application of the institutional fall risk protocol, to ensure greater patient safety during hospitalization.

Conclusion

The incidence of falls among elderly people undergoing enteral nutritional therapy was less than 10%, and approximately 70% of patients presented a moderate or high risk of falling during hospitalization. No significant association was detected between this risk, as measured by the SAK Fall Risk Scale, and nutritional status according to BMI, but there was a higher percentage of falls among patients with inadequate calf circumference. Patients who fell had, at most, minor injuries. Although the length of stay was prolonged and all patients were discharged from the hospital, the findings of this study reinforce the relevance of scales that identify the risk of falling and the need to apply care protocols to subgroups of patients who are more exposed to this event.

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How to cite this article