

Falls among individuals with spinal cord injury: characterization of patients admitted for physical rehabilitation

Quedas em indivíduos com lesão medular em hospital de reabilitação: caracterização de uma amostra

 Naira Beatriz Favoretto Cunha¹,  Gabriela Afonso Galante Maia¹,  Danyelle Rodrigues Pelegrino Reuter¹,  Marjoyre Anne Lindozo Lopes¹

ABSTRACT

Falls are defined as an unintentional body displacement towards a level below the initial position, with the inability to correct the body promptly. In hospitals, falls are more frequent among the elderly, those with neurological impairment, and patients under physical rehabilitation. **Objectives:** This is a descriptive retrospective study to characterize patients with spinal cord injury who underwent falls when admitted to a rehabilitation hospital and establish the association between clinical characteristics and the presence or absence of injuries due to the fall. **Method:** Data were collected from medical records between January 2015 and December 2017. The sample consisted of patients aged 18 years or above with spinal cord injury. Medical records whose data did not allow the study variables to be retrieved were excluded. The statistical analysis included data description followed by Pearson's exact chi-square test to establish the association between clinical and demographical variables and the presence of injuries due to the fall, except for age, which was analyzed with Mann-Whitney's test. **Results:** 173 medical records were included and analyzed. A higher frequency of falls was observed among men with paraplegia, during the day, during unsupervised activities, and while using a wheelchair. There was no association between the clinical or demographical variables and falls with injuries. **Conclusion:** Falls mainly affect individuals with thoracic injuries, wheelchair users during locomotion, transfers, and when they are lifting or tilting their wheelchairs. The findings reiterate the importance of training for wheelchair users to enhance their abilities.

Keywords: Accidental Falls, Spinal Cord Injuries, Rehabilitation Centers

RESUMO

Queda é definida como o deslocamento não intencional, com incapacidade de correção em tempo hábil do corpo a um nível inferior à posição inicial. Quedas, em hospitais, são mais frequentes em unidades com pacientes idosos, neurológicos e de reabilitação. **Objetivo:** Trata-se de um estudo descritivo de análise retrospectiva, com objetivo de caracterizar o perfil dos pacientes com lesão medular (LM) que apresentaram queda durante internação em um hospital de reabilitação e analisar a associação das características clínicas e das quedas dos pacientes com a presença ou não de dano após a queda. **Método:** Dados coletados de prontuários entre janeiro/2015 e dezembro/2017. A amostra compôs-se de pacientes adultos com LM. Excluídos prontuários cuja análise não permitiu o levantamento dos dados. A análise estatística utilizou medidas de tendência central e dispersão para as variáveis quantitativas e medidas de frequência para as categóricas. Utilizado teste Qui-quadrado de Pearson exato para avaliar a associação das variáveis e presença de dano após queda, com exceção da idade, analisada pelo teste Man-Whitney. **Resultados:** Analisados 173 prontuários. Observou-se maior frequência de quedas em homens com paraplegia, durante o dia, em atividades não supervisionadas e durante o uso de cadeira de rodas. Não houve associação entre as variáveis de caracterização da amostra e quedas com dano. **Conclusão:** As quedas acometeram principalmente indivíduos com lesões torácicas, usuários de cadeira de rodas, durante a locomoção, transferências e ao empiná-las. Ressalta-se a importância do treino de habilidades em cadeira de rodas para ampliar as habilidades no uso desse recurso.

Palavras-chaves: Acidentes por Quedas, Traumatismos da Medula Espinal, Centros de Reabilitação

¹ Rede Sarah de Hospitais de Reabilitação - Unidade em Belo Horizonte

Address for correspondence
Naira Beatriz Favoretto Cunha
E-mail: nairafavoretto@gmail.com

Submitted: February 2, 2022
Accepted: May 6, 2022

How to cite
Cunha NBF, Maia GAG, Reuter DRP, Lopes MAL. Falls among individuals with spinal cord injury: characterization of patients admitted for physical rehabilitation. *Acta Fisiatr.* 2022;29(2):98-103.



10.11606/issn.2317-0190.v29i2a194458



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INTRODUCTION

A fall is an unintentional displacement of the body towards a level below the initial position, combined with the inability to correct it promptly, caused by multifactorial circumstances that compromise stability.^{1,2} A fall is considered when the individual is found lying or sitting on the ground, or when they need help not to reach the ground once stability is compromised.³ The rate of patient falls in hospitals in developed countries is between 3 to 5 falls per 1,000 Patient Days, being more frequent in hospitals for the elderly, those with neurological disorders, and patients with disabilities.⁴ Episodes of falls can lead to more extended hospital stays, consequently increasing hospital costs, patient harm such as injuries and fractures, and anxiety and fear of falling again, increasing the risk of falls.^{5,6}

One of the roles of the Patient Safety Centers in the management of hospital risks is the prevention of falls.⁷ Prevention protocols are composed of specific tools for risk assessment of falls, the practice of individualized preventive actions based on the risk of falls, patient and caregiver education, and effectiveness assessment of the interventions by notifications of falls and indicators of process and outcomes.^{8,9,10}

In hospital settings, falls are most often considered preventable events. Identifying patients with high risk for falls, as classified by a multidisciplinary team, displays the need for preventive actions, such as promoting a safe hospital environment, the use of assistive devices for mobility, and supervision by caregivers/professionals during the rehabilitation activities.¹¹ In this context, the importance of using risk assessment instruments is emphasized, and the Morse Scale is one of the most commonly applied, as it lists the various intrinsic factors that can lead to falls. In summary, the Morse Scale assesses the patient's previous history of falls, the number of morbidities, their mode of locomotion, and whether they require intravenous devices or other physically limiting therapies, associating these variables with the current gait and the mental status.¹² In the specialized literature, there is no specific predictive scale for hospital falls for patients with spinal cord injury (SCI). Therefore, rehabilitation hospitals undergo challenges in classifying SCI patients according to the risk of falls due to the lack of risk stratification evaluations sensitive to their disability mobility conditions.

Falls are common events among community-dwelling individuals with SCI. It is estimated that the incidence of falls is 78% and 69% for those with gait ability or wheelchair users, respectively. Sensorimotor deficits, such as muscle paresis or paralysis, reduced trunk control, spasticity, and decreased sensitivity and proprioception are biological factors that contribute to falls. In addition, behavioral aspects such as impulsivity, environmental factors such as architectural barriers, or lack of safety equipment also aggravate the occurrence of falls in this population.¹³ However, there is still no consensus on the main risk factors for falls in individuals with SCI, and there are differences between individuals who walk and those who need a wheelchair for mobility.¹³⁻¹⁵ The most common causes of falls among community-dwelling wheelchair users with SCI are transfers, self-propelled wheelchair, attempt to reach for objects, movements in bed,

and bathing.^{16,17} In addition, patients with SCI report that falls at home and in a community environment are usual events, even with the increased risk of fractures and other fall-associated injuries that can directly jeopardize their quality of life.¹⁶

Despite the growing number of studies on falls of community-dwelling patients with SCI, there are a limited number of studies on falls of SCI individuals in rehabilitation hospitals.^{18,19} The few articles regarding this subject have observed that SCI individuals have a higher rate of falls in rehabilitation hospitals when compared to those with neurological diagnoses. The risk factors, causes, and circumstances of falls in individuals with SCI in a hospital setting may be different from those already identified in a community environment.^{13,18} Moreover, there are no specific instruments for assessing the risk of falls in individuals with SCI hospitalized for physical rehabilitation, which may contribute to a higher incidence of falls. Therefore, health professionals need to know the profile of individuals with SCI who had falls during hospitalization in a rehabilitation hospital, as it may help identify the possible risk factors and enable preventive measures. Furthermore, emphasizing activities and possible issues related to falls may also promote awareness of patients and caregivers in adhering to preventive measures.

OBJECTIVE

The primary objective of this study was to characterize the profile of SCI patients who had a fall during hospitalization in a rehabilitation hospital, the device and activity involved in the fall, the place of the fall, and the occurrence of physical injury.

The secondary objective was to analyze the association of the patients' clinical characteristics with the presence or absence of physical injury due to the fall.

METHODS

This descriptive and retrospective study was designed according to the recommendations of Resolution 466/12 of the Brazilian National Health Council. It was approved by the Research Ethics Committee of The SARAH Network of Rehabilitation Hospitals (Rede SARAH de Hospitais de Reabilitação), with the registration number (CAAE) 99681218.9.0000.0022 and approval number 3224519. As this was a retrospective study with data collection from medical records, the signing of the Informed Consent Form (ICF) was exempted.

Data from electronic medical records of patients hospitalized at the Spinal Cord Injury Neurorehabilitation Program of a Rehabilitation Hospital were retrieved between January 2015 and December 2017. The inclusion criteria for including data from the medical records were patients with spinal cord injury, aged 18 years or above, who had at least one episode of fall during the hospitalization period. Patients with incomplete electronic medical record data and who did not allow the data extraction for the study were excluded.

Variables

1) Demographic and clinical characteristics: age, sex, type of SCI (traumatic or non-traumatic), SCI level, and classification according to the International Standards for Neurological

Classification of SCI (ISNCSCI) of the American Spinal Injury Association (ASIA Impairment Scale),²⁰ lower limbs spasticity (present or absent), type of locomotion (wheelchair or gait), and reason for hospitalization (rehabilitation or clinical/surgical treatment).

2) Characteristics of falls: device involved in the fall (stretcher, wheelchair, walker), the activity involved in the fall (decubitus changes, transfers, use of a wheelchair, gait), place of fall, the moment of the fall (morning, afternoon, night or dawn), presence of injuries associated with the fall (skin injury, sprain, fracture).

The statistical analysis started with the data description. According to the Shapiro-Wilk test, the median and interquartile range described the quantitative variable of age at admission due to the non-normal distribution. Categorical variables (gender, traumatic or non-traumatic SCI, neurological level, injury classification, lower limb spasticity, type of locomotion, reason for hospitalization, device involved in the fall, the activity involved in the fall, place of the fall, period of the day when the fall occurred, and presence of injury associated with the fall) were described with absolute frequencies and percentages.

Pearson's exact chi-square test was conducted to test the association between the categorical variables and the presence of injury due to the fall. Additionally, the Man-Whitney test was applied to establish the association with age. The SPSS software version 20.0 was used for all data analysis, and the significance level used was 0.05.

RESULTS

A total of 1,796 patients with SCI were admitted to the Rehabilitation Program, and 1,623 electronic medical records that did not report any falls during hospitalization were excluded from the analysis. Falls were present in 173 medical records, approximately 10% of all hospitalizations during the studied period.

The characteristics of the patients reported in the medical records are detailed in Table 1. The main reason for hospitalization was Rehabilitation (166 patients, 96%), whereas the other patients were hospitalized for clinical or surgical treatment. In the sample, 146 patients (84%) used a wheelchair for locomotion, and 27 (16%) had gait capabilities.

Regarding the device involved in the fall, the wheelchair was present in 113 cases (65%), bed in 27 (15%), and bath chair in 19 (11%) (Figure 1). Most activities being performed during the fall involved using a wheelchair (65%) in situations of mobility, when rearing or front tilting, transfers, and even in activities when the wheelchair was stopped (Table 2).

Most falls occurred during activities not supervised by a rehabilitation professional, corresponding to 125 patients (72%), and the most frequent place of the fall was within the wards (71%) (Table 3). Considering the time of day, 75 falls occurred in the morning (43%), 68 in the afternoon (39%), 20 at night (12%), and ten at dawn (6%).

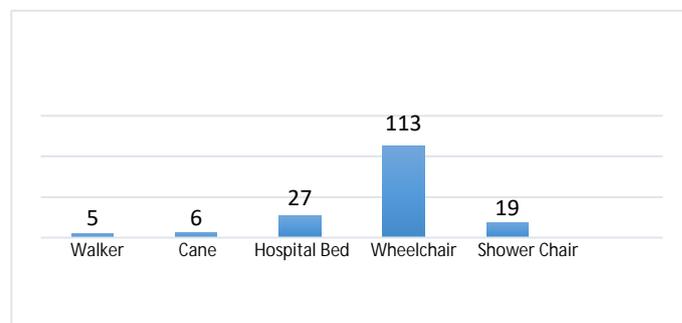
The injury occurrence due to the fall was observed in 17 patients (10%). Skin injuries occurred in 13 patients (8%), bruises in 3 (2%), and fractures in 1 (1%). Statistical analysis was conducted to identify the association between the sample characteristics and falls with injuries. There were no significant differences between the groups with and without injuries in

any analyzed variables (Table 4).

Table 1. Sample characteristics and distribution

Variables	n= (173)
Age (years), median (IQR)	30 (23;43)
Sex n (%)	
Male	141 (81.5)
Female	32 (18.5)
Etiology n (%)	
Traumatic	156 (90.2)
Non-traumatic	17 (9.8)
SCI type n (%)	
Paraplegia	135 (78)
Tetraplegia	38 (22)
Injury level n (%)	
Cervical	36 (20.8)
Thoracic T1-T6	50 (28.9)
Thoracic T7-T12	77 (44.5)
Lumbar	10 (5.8)
AIS n (%)	
A	109 (63.0)
B	19 (11.0)
C	23 (13.3)
D	22 (12.7)
Spasticity n (%)	
Yes	118 (68)
No	55 (32)
Gait ability n (%)	
No	146 (84.4)
Yes	27 (15.6)

IQR, interquartile range; SCI, spinal cord injury; AIS: American Spinal Injury Association Impairment Scale



* 3 patients did not use any assistive device and fell from their own height

Figure 1. Sample distribution according to the assistive device involved in the fall

Table 2. Sample distribution according to the activity involved with the fall

Activity	n	%
Decubitus change / Transference from the hospital bed	27	16
Dressing/Toiletry (shower chair)	19	11
Activities with wheelchair	113	65
<i>Mobility with wheelchair</i>	48	28
<i>Front tilt of wheelchair</i>	27	16
<i>Still (stopped) wheelchair</i>	12	6
<i>Transfers form wheelchair</i>	26	15
Gait	14	8
Total	173	100

Table 3. Sample distribution according to the fall location

Fall Location	n	%
Infirmery	122	71
Physiotherapy gym	14	8
External area of the hospital	16	9
Sports court	14	8
Others	7	4
Total	173	100

Table 4. Statistical analysis of variables associated with the injuries due to the falls

Variables	Injuries		p-Value
	Yes n= 17	No n= 156	
Sex			
Male	12 (8.5%)	129 (91.5%)	0.222
Female	5 (15.6%)	27 (84.4%)	
Etiology			
Traumatic	14 (9.0%)	142 (91.0%)	0.381
Non-traumatic	3 (17.6%)	14 (82.4%)	
SCI level			
High thoracic	6 (12.0%)	44 (88.0%)	0.54
Low thoracic	7 (9.1%)	70 (90.9%)	
Cervical	2 (5.6%)	34 (94.4%)	
Lumbar	2 (20.0%)	8 (80.0%)	
AIS			
A	8 (7.3%)	101 (92.7%)	0.103
B	4 (21.1%)	15 (78.9%)	
C	1 (4.3%)	22 (95.7%)	
D	4 (18.2%)	18 (81.8%)	
Gait ability			
Yes	4 (14.8%)	23 (85.2%)	0.478
No	13 (8.9%)	133 (91.1%)	
Age (median; IQR)	30.00 (27.00; 53.50)	30.50(22.25; 43.00)	0.261

SCI: spinal cord injury; AIS: American Spinal Injury Association Impairment Scale

DISCUSSION

The falls of hospitalized patients are vital for the quality control system, as they reflect a breach of safety, being responsible for the increase in the number of hospitalization days and worse recovery conditions.²¹ The identification of intrinsic and extrinsic risk factors is a challenge for professionals who need to address them.^{22,23} It is essential that preventive actions are multidisciplinary, involving the patient and the caregiver. In this context, our study aimed to identify

the profile and primary reasons for falls among SCI patients admitted to a rehabilitation hospital so that strategies to manage the risk for falls are applied according to the particularities of patients with SCI.

In the three years evaluated in this study, 10% of hospitalized patients with SCI underwent falls during their rehabilitation program, which is a lower figure when compared to other studies.^{18,19,24} We observed that the sample of this study was primarily composed of young males with paraplegia at the thoracic level, agreeing with the findings of Santiago et al.²⁵ who demonstrated that the majority of their sample was composed of young males with a diagnosis of paraplegia. The mean age of our sample was 31 years, similar to the data of a systematic review that shows an age peak between 15 and 29 years among patients with spinal cord injury, meeting the classification of the active population.^{26,27}

Regarding the patient profile, the higher frequency of falls among patients with paraplegia when compared to those with quadriplegia can be explained by their greater potential for participation in daily activities, such as transfers from bed to wheelchair and the technique of rearing or front-tilting the wheelchair, being consequently more exposed to the risk of falling. In most cases, the patient with quadriplegia needs assistance with these activities. Patients with paraplegia remain hospitalized for rehabilitation without a caregiver precisely to enhance the acquisition of greater independence for self-care and mobility activities. In a community environment, falls are more frequent among patients with SCI with gait abilities when compared to wheelchair users.¹³

Considering the general population admitted to rehabilitation hospitals, falls seem to be more frequent among wheelchair users,²⁴ which corroborates with the results of our study, where 84% of the individuals who suffered falls were using a wheelchair. This issue can also be explained by the profile of patients with SCI admitted to our hospital for rehabilitation, as most of them had paraplegia from complete SCI. Moreover, the most common situations in which falls occurred in our study were wheelchair propulsion activities, transfers, and wheelchair front up tilt, which corroborates previously published studies.^{16,17} Therefore, training wheelchair handling skills is essential for achieving functional independence, favoring greater patient safety, and reducing the risk of falls.²⁸

Wilson et al.¹⁹ also reported that most of the falls occurred during the day (80%), in the ward area (70%) when the patient was unsupervised, i.e., not performing rehabilitation activities. Therefore, applying educational activities to raise the awareness of the patient and the caregiver regarding the prevention of falls can be considered a valid strategy, as most falls occur when the patient is not being assisted by a rehabilitation professional.

In our study, injuries (skin injury, fractures, and others) were observed in 10% of the medical records, similar to the numbers reported by Vlahov²⁴ but lower than those observed by Wilson et al.¹⁹

Injuries such as skin lesions were the most frequently observed, which meets the results found by Khan et al.¹³ in a systematic review that reported minor injuries are the most common. However, when comparing the patients with and without injuries, no statistically significant difference was

found in any of the variables evaluated. The interference of the reduced sample number of the group with injuries should be considered.

In a rehabilitation institution, where the patient performs activities to promote his maximum possible independence, the fall can represent the interruption of the rehabilitation program. In the event of skin injuries, bone fractures, or any other physical damage that jeopardizes the performance of activities, the patient will have to suspend the rehabilitation program and postpone their treatment temporarily. Therefore, preventing falls and avoiding injuries is a crucial strategy for the success of a rehabilitation program. In addition, the occurrence of psychosocial damage after a fall is also observed. Patients report feelings of fear, embarrassment, and frustration, diminishing their participation in daily activities.¹³

Concerning health education, actions to involve the patient and their companion in the commitment to prevent falls may bring positive results. Individualized programs, added to the professional team's training, reduce the rates of falls and the resulting injuries.²⁹ In this context, fall prevention strategies require an approach that involves a safety culture and the implementation of care protocols and guidelines for patients and caregivers or companions.

A limiting factor of our study is the lack of a control group formed of patients with SCI who did not undergo falls. This control group would have allowed a more robust analysis to identify variables that would better understand the influencing factors regarding falls of patients with SCI in a rehabilitation institution. We also point out the possible bias in data collection given the secondary data source, the electronic medical records.

CONCLUSION

This study showed that the falls of patients with SCI in a rehabilitation hospital mainly affected individuals with injuries at the thoracic level and wheelchair users, occurring prevalently during activities of locomotion in a wheelchair, transfers to the bed, and when lifting or front tilting the wheelchair. We emphasize the importance of training in wheelchair skills to expand patients' ability to use this resource.

From the results of this study, we conclude that educational strategies for sensitizing patients at greater risk of falling can be included as preventive measures, as falls occur more frequently in unsupervised activities, not during rehabilitation procedures. In addition, aiming to prevent falls, the authors also reinforce the need for awareness and training of the multidisciplinary rehabilitation team.

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