Original article

SAME-LEVEL FALLS IN OLDER ADULTS: FACTORS ASSOCIATED WITH TRAUMATIC BRAIN AND SPINAL CORD INJURIES*

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ABSTRACT: Objective: to identify factors associated with the occurrence of traumatic brain and spinal cord injuries among older adults who suffered a same-level fall. Method: a retrospective study, with 192 medical records of older adults that suffered a same-level fall in 2014 and were attended in the Emergency Care Unit of a teaching hospital in Paraná. The Z test was performed to compare the proportions of the groups with (n=80) and without (n=112) traumatic brain or spinal cord injuries with demographic, health, fall and evaluation/care data. Results: 80 (41.7%) of the older adults identified had traumatic brain or spinal cord injuries. There was a significant association of the occurrence of traumatic brain or spinal cord injuries with: male gender (p=0.0109), specialized transport (p=0.0001), fall on public road (p=0.0026), absence of arterial hypertension p=0.0434) and presence of psychiatric illness (p=0.0048). Conclusion: traumatic brain and spinal cord injuries are frequent events associated with same-level falls, which indicates the need for educational and preventive measures aimed at the reduction of falls.

DESCRIPTORS: Health services for the older adults; Aging; Traumatology; Wounds and injuries; Emergency medicine.

QUEDA DO MESMO NÍVEL EM IDOSOS: FATORES ASSOCIADOS AO TRAUMA CRANIOENCEFÁLICO E RAQUIMEDULAR

RESUMO: Objetivo: identificar fatores associados à ocorrência de trauma cranioencefálico e raquimedular entre idosos que sofreram queda do mesmo nível. Método: estudo retrospectivo, com 192 prontuários de idosos que sofreram queda do mesmo nível em 2014 e foram atendidos no Pronto Atendimento de um hospital de ensino do Paraná. Realizou-se teste Z, para comparação de proporções do grupo com (n=80) e sem (n=112) trauma cranioencefálico ou raquimedular com dados demográficos, de saúde, da queda e da avaliação/atendimento. Resultados: dos idosos identificados, 80 (41,7%) tiveram traumatismo cranioencefálico ou raquimedular. Houve associação significativa com a ocorrência de traumatismo cranioencefálico ou raquimedular: sexo masculino (p=0,0109), transporte especializado (p=0,0001), queda em via pública (p=0,0026), ausência de hipertensão arterial (p=0,0434) e presença de doença psiquiátrica (p=0,0048). Conclusão: o trauma cranioencefálico ou raquimedular é um evento frequente associado à queda do mesmo nível, o que denota a necessidade de medidas educativas e preventivas visando à redução da quedas.

DESCRITORES: Serviços de saúde para idosos; Envelhecimento; Traumatologia; Ferimentos e lesões; Medicina de emergência.

CAÍDA DESDE ALTURA SIMILAR EN ANCIANOS: FACTORES ASOCIADOS AL TRAUMA CRANEOENCEFÁLICO Y RAQUIMEDULAR

RESUMEN: Objetivo: Identificar factores asociados a la ocurrencia de traumas craneoencefálicos y raquimedulares entre ancianos que sufrieron caídas desde alturas similares. Método: Estudio retrospectivo, con 192 historias clínicas de ancianos que cayeron desde alturas similares en 2014, atendidos en la Guardia de un hospital de enseñanza de Paraná. Se realizó test Z para comparación de proporciones del grupo con (n=80) y sin (n=112) trauma craneoencefálico o raquimedular con datos demográficos, de salud, de la caída y de la evaluación/atención. Resultados: Ochenta (41,7%) ancianos sufrieron traumatismo craneoencefálico o raquimedular. Existió asociación significativa con traumatismo craneoencefálico o raquimedular en: sexo masculino (p=0,0109), transporte especializado (p=0,0001), caída en vía pública (p=0,0026), ausencia de hipertensión arterial (p=0,0434) y presencia de enfermedad psiquiátrica (p=0,0048). Conclusión: El trauma craneoencefálico o raquimedular constituye un evento frecuentemente asociado a caídas desde niveles similares, expresando ello necesidad de medidas educativas y preventivas apuntando a reducir las caídas.

DESCRIPTORES: Servicios de Salud para Ancianos; Envejecimiento; Traumatología; Heridas y Lesiones; Medicina de Emergencia.

* Article derived from the Master's dissertation "Association between the use of drugs and the risk factors for falling in elderly patients with chronic degenerative diseases seen in the Emergency care Unit of a university hospital public reference in the northwest of Paraná". State University of Maringá, 2016.

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Received: 14/11/2017
Finalized: 22/08/2018

http://dx.doi.org/10.5380/ce.v24i3.56325

INTRODUCTION

The increase in the older adult population is a relevant fact and requires attention. In Brazil, older adults (aged 60 years or more) represent 10.8% of the population, corresponding to more than 20.5 million people[1]. The advance of age, plus longevity, brings physical and mental changes that lead to an increased risk of falls[2]. However, falling is a multifactorial event and, in this sense, studies by some authors[3-5] have highlighted various risk factors and consequences of falls.

The occurrence of falling is related to incompatibility between the physiological function of the individual, the environment and behavioral factors[2], that is, there are several risk factors for falling in older adults: advanced age, female gender, physical frailty, muscular weakness, unstable gait and balance, impaired cognition, nutritional deficiency, irregular sleep, visual impairment and the presence of chronic diseases with consequent use of medication, among others[4,6].

It is estimated that, annually, one third of older adults suffer some type of fall and, of these, approximately 10% to 15% cannot withstand the injury[7] evolving to death. Among the most worrying injuries are femoral fractures, traumatic brain injury (TBI) and traumatic spinal cord injury (TSCI), due to the severity of the consequences and the impact on the health of the victim, with a high possibility of temporary or permanent disability.

The costs of care for older adults that suffer a fall and are left with sequelae are high. In addition to the impossibility of performing daily activities, the occurrence of falling triggers financial consequences for the public health system and for the relatives responsible for the treatment of the older adult[8]. Thus, the identification of risk factors for falling, as well as the monitoring of the type, severity, incidence and prevalence of falls are important for the elaboration and implementation of preventive measures and care protocols that make the care more efficient[9]. Some national studies have analyzed the occurrence of TBI and TSCI in the morbidity and mortality profile of the older adult Brazilian population, and identified falling[10-11] as one of their main causes.

In view of the above, this study aimed to identify the factors associated with the occurrence of TBI or TSCI among elderly people that suffered a fall from their own height.

METHOD

This cross-sectional, retrospective, quantitative study was developed in the Emergency Care Unit (ECU) of a public teaching hospital in Paraná. Cross-sectional studies make it possible to visualize the situation of a population at any given time[12]. The ECU operates continuously and adopts the Risk Assessment Screening System (RASS), a strategy to organize the emergency services, with prioritization of more serious cases[13] for the entrance of patients into the health services.

A non-probabilistic sample was selected by convenience from a report issued by the Health Care Management System (GSUS-PR), with all patients who suffered a fall in the year 2014. Older adult patients (aged 60 years or over), who suffered a same-level fall (stumbling or slipping), attended in the ECU and with the opening of the Hospitalization Authorization (HA), were considered as inclusion criteria, since the initial care form was not always linked to the opening of the medical record to obtain the data. The absence of a HA was considered as the exclusion criterion.

A total of 859 cases resulting from falling were identified in the ECU during the investigation period. Of these, 627 were excluded because they were not older adults, 21 because they were older adults that suffered a fall from a height, 5 because they were older adults that had no type of injury and 14 because they were older adults whose data were incomplete (characterization, fall level or fall complication), totaling 192 participants who had a same-level fall, 80 of whom had TBI and/or TSCI, whose records were located and used in the data collection.

The patients who met the inclusion criteria were dichotomized as with or without TBI and/or TSCI to enable statistical association tests, and thus to achieve the proposed objective. A structured instrument was developed for this study, containing demographic characterization data (gender and age), health history (comorbidities, use of medication at home and previous falls), the fall (location,

cause, period of occurrence and initial care) and of the initial evaluation in the ECU (type of injury, length of hospitalization and outcome of the case).

The data were entered into a Microsoft Excel 2010 worksheet and analyzed statistically using the Statistica Single User program, version 13.2. For the qualitative variables, absolute frequency and percentage tables were used followed by the Z test for the comparison of proportions. For the description of the hospitalization time, the mean was compared with the length of hospitalization between the groups with and without TBI/TSCI. The level of significance adopted in the statistical tests was 5%, that is, comparisons with a p-value of less than or equal to 0.05 were considered significant.

All the relevant ethical and legal precepts were followed and the research project was approved by the Research Ethics Committee, authorization No. 1.055.333.

RESULTS

A total of 92 older adults participated, 121 (63%) being female and 71 (36.9%) male, ranging in age from 60 years to 90 years or over; with the length of hospitalization from 1 to 57 days (without TCE/TSCI: mean=5 ± 7.7 days and with TBI/TSCI: mean=3.9 ± 3.8 days). The majority of patients with TBI/TSCI arrived at the ECU in specialized transport (56 - 70%), with the majority (53 - 66.3%) receiving a yellow classification.

Table 1 presents the association of initial care variables with the occurrence (or not) of TBI/TSCI.

Table 1- Characterization of the initial care to the older adults who suffered a same-level fall and were attended in the ECU. Maringá, PR, Brazil, 2014

Variables	Without TCE/TSCI n (%)	With TCE/TSCI n (%)	P-value
Transportation to ECU			
Not specialized [a] (n=103)	79 (70.5)	24 (30.0)	0.0001*
Specialized [b] (n=89)	33 (29.5)	56 (70.0)	0.0001*
Classification of risk[c]			
More Urgent - Yellow (n=114)	61 (54.5)	53 (66.3)	0.1007
Less Urgent - Green (n=48)	38 (33.9)	10 (12.5)	0.0007*
Emergency - Red (n=2)	1 (0.9)	1 (1.3)	0.7902
Not recorded (n=28)	12 (10.7)	16 (20.0)	0.0718

*p-value significant according to the test Z considering a significance level of 5%.
[a] Includes own vehicle, accompaniment by relatives or collective transport.
[b] Includes SIATE or SAMU emergency vehicle.
[c] Classification recorded on the patient's medical record.

Table 2 shows that in the association test for the occurrence of TBI/TSCI in older adult patients that suffered a same-level fall with TBI/TSCI, the age range from 60 to 70 years was predominant (36 – 45.0%), as was falling at home (55 – 68.8%), with discharge in the majority of cases (77 - 93.6%); not having a chronic disease presented a high frequency.

Table 2 - Distribution of the factors associated with TBI and TSCI in older adult patients who suffered a same-level fall attended in the ECU. Maringá, PR, Brazil, 2014

Factors [a]	Without TCE/TSCI n (%)	With TCE/TSCI n (%)	P-value
Age group			
From 60 to 70 years (n=81)	45(40.2)	36 (45.0)	0.5067
From 71 to 80 years (n=67)	43 (38.4)	24 (30.0)	0.2286
From 81 to 90 years (n=37)	19 (17.0)	18 (22.5)	0.3410
91 or more (n=7)	5 (4.5)	2 (2.5)	0.4673
Gender			
Female (n=121)	79 (70.5)	42 (52.5)	0.0109*
Male (n=71)	33 (29.5)	38 (47.5)	0.0109*
Fall location			
Home (n=152)	97 (86.6)	55 (68.8)	0.0027*
Work (n=3)	1 (0.9)	2 (2.5)	0.0925
Public road (n=36)	13 (11.6)	23 (28.8)	0.0026*
Care home (n=1)	1 (0.9)	- (0.0)	0.3949
Outcome			
Discharge (n=187)	110 (98.2)	77 (96.3)	0.4140
Death (n=5)	2 (1.8)	3 (3.8)	0.3935
Fall in the shower			
Yes (n=11)	5 (4.5)	6 (7.5)	0.3787
No (n=181)	99 (88.4)	70 (87.5)	0.8498
Systemic hypertension (SH)			
No (n=106)	55 (49.1)	51 (63.8)	0.0434*
Yes (n=86)	57 (50.9)	29 (36.3)	0.0449*
Diabetes mellitus (DM)			
No (n=163)	98 (87.5)	65 (81.3)	0.2366
Yes (n=29)	14 (12.5)	15 (18.8)	0.2297
Stroke			
No (n=184)	109 (97.3)	75 (93.8)	0.2310
Yes (n=8)	3 (2.7)	5 (6.3)	0.2202
Neurological/psychiatric disorder [b]			
No (n=161)	101 (90.2)	60 (75.0)	0.0048*
Yes (n=31)	11 (9.8)	20 (25.0)	0.0048*
Osteomuscular disease[c]			
No (n=189)	111 (99.1)	78 (97.5)	0.3788
Yes (n=3)	1 (0.9)	2 (2.5)	0.0674

*p-value significant according to the test Z considering a significance level of 5%.
[a] Ignored data was not presented.
[b] Includes: dementia, anxiety, depression, Alzheimer's disease, Parkinson's disease, seizure disorder, aneurysm, and multiple sclerosis.
[c] Includes: osteoporosis, arthritis, arthrosis.

Among the participants, 115 (59.9%) used some type of medication and 71 (63.4%) had no TBI/TSCI, while 44 (55%) had TBI/TSCI. The relationship between use of medications and the occurrence of TBI/TSCI in the older adult patients who suffered a same-level fall is shown in Table 3.

Table 3 - Distribution of the medications associated with the occurrence of TBI and TSCI in older adult patients who suffered a same-level fall attended in the ECU, 2014

Medication	Without TCE/TSCI n (%)	With TCE/TSCI n (%)	P-value
Antihypertensive			
No (n=125)	69 (61.6)	56 (70.0)	0.2286
Yes (n=67)	43 (38.4)	24 (30.0)	0.2286
Psychotropic			
No (n=164)	97 (86.6)	67 (83.8)	0.5877
Yes (n=28)	15 (13.4)	13 (16.3)	0.5749
Insulin and Hypoglycemic			
No (n=175)	103 (92.0)	72 (90.0)	0.6302
Yes (n=17)	9 (8.0)	8 (10.0)	0.6302
Antiarrhythmic			
No (n=187)	110 (98.2)	77 (96.3)	0.4140
Yes (n=5)	2 (1.8)	3 (3.8)	0.3935
Analgesic			
No (n=191)	111 (99.1)	80 (100)	0.3949
Yes (n=1)	1 (0.9)	0 (0.0)	0.3949
Hormone Therapy			
No (n=188)	109 (97.3)	79 (98.8)	0.7551
Yes (n=4)	3 (2.7)	1 (1.3)	0.5064

*p-value not significant according to the test Z considering a significance level of 5%.

DISCUSSION

In the present study, the incidence of TBI/TSCI was observed in older adults who had some type of complication due to a same-level fall (n=80, 41.7%). However, it is difficult to quantify the real dimension of the trauma in the older adult, because the total incidence of the injuries is unknown, as many are not reported. Trauma indices are important in measuring the severity of the lesions and calculating the probability of survival, helping in the evaluation of the quality of the care[14-15].

Regarding the duration and evolution, the injuries in the older adult patient are more critical and, consequently, consume more resources and cause a greater impact on the lives of the family members. Falls are an important public health problem due to their frequency, morbidity and high social and economic cost as a result of the injuries caused[8]. It should be mentioned that, in 2017, in Brazil, there were more than 9 million urgent hospital admissions financed by the Brazilian Nation Health System (Sistema Único de Saúde - SUS) and of these 25% were individuals aged 60 or over[16].

It was verified in the present study that the older adults that presented TBI/TSCI arrived at the hospital by specialized transportation (p=0.0001), while those that did not suffer this injury arrived alone, with family members, or by transportation of the city (p=0.0001).

Specialized help and transport can minimize the possible consequences of a trauma, while denoting greater severity, such as in cases of TBI or TSCI. However, this should be, if not the only one, at least the main type of transport used in the circumstances of falls and/or other types of trauma in older adults, since adequate help and transportation can minimize the possible consequences of the trauma.

It should be noted that the access of older adults to the ECU with a history of trauma, without specialized transportation, has been verified in other studies[17]. Thus, the importance of the mobile pre-hospital care service, the professionals of which are trained to identify and intervene in severe conditions, as well as in specific conditions of older adults, should be emphasized. Specialized pre-

hospital care with benefits of screening and rapid intervention in cases of acute conditions and trauma is important, with transfer to specialized services that meet the needs and contribute to the reduction of mortality and sequelae of the trauma, avoiding late and inadequate initial care[18].

The information referring to the risk assessment of the older adults was based on a protocol that prioritized care according to the clinical indication, classifying it into colors with different waiting times, in order to reduce the number of avoidable deaths, sequelae and hospitalizations[13]. Although it was verified that the patients with TBI/TSCI were associated with the less urgent classification (green), patients with TBI/TSCI were not associated with the more severe risk classifications (yellow or red). Despite this, it is important to note that the data may have been influenced by the number of patients ignored, since the RASS in the institution functioned 18 hours a day (7:00 a.m. to 01:00 a.m.).

The absence of a risk assessment may expose the patient to a worsening of the condition, since it is based on protocols that take into account clinical criteria[13,19]. The risk assessment aims to identify the patient with a potential risk to life, which allows for the increase of the resolution of the disease events and reduction in the degree of suffering of the user, when care is a priority. This indicates that, in this study, although some older adult patients that suffered a fall may have been classified as less urgent cases, their clinical condition may have worsened later.

Regarding the length of hospitalization after the trauma, older adults remain hospitalized for a longer period than young adults[20]. However, a study with older adults and younger adult victims of trauma in the city of Curitiba-PR showed no significant difference between the groups, with a mean of 7.66 days of hospitalization[21]. In the present study, the length of hospital stay of the older adults who suffered a same-level fall was not associated with TBI/TSCI, with the hospitalization time being 3.9 ± 3.8 days among these individuals.

Considering mortality, although no statistical difference was observed, the proportion of deaths was higher among the patients who had TBI/TSCI. The number of deaths may not represent the real situation, as the patients were transferred to other hospital institutions, of which the clinical outcome was unknown. Studies show that, regarding trauma, injuries are more severe in older adults compared to young adults, with a greater need for intensive care (IC), longer hospitalization and higher mortality rate[20,22]. Thus, trauma and its sequelae have become one of the major public health problems, with increasing incidence and mortality.

Regarding gender, Table 2 shows that there was a higher prevalence of falls without TBI/TSCI in female patients, whereas males presented a higher prevalence of falls with TBI/TSCI. A study carried out in São José do Rio Preto-SP[23], with 535 older adult victims of trauma, showed that the number of falls was 373 (69.7%), with females being more prevalent (192 - 52.4%). The higher frequency of falls suffered by females can be explained by the fact that they are more fragile, more active inside and outside the home and because of the prevalence of chronic diseases[24].

Statistically significant results were observed among older adults who had and did not have TBI/TSCI regarding gender, presence of hypertension and psychiatric disorders; this may mean that these variables are associated with the occurrence of falls in older adults, however, have no influence on the occurrence of TBI/TSCI. It was verified, for example, that patients without SH had a higher prevalence of falling with TBI/TSCI, whereas the patients with SH presented a prevalence of falls without TBI/TSCI.

Regarding neurological and psychiatric disorders, it was observed that the patients with neurological disease had a higher prevalence of falls with TBI/TSCI and those without neurological disease had a higher prevalence of falls without TBI/TSCI. This can be explained by the physical and mental limitations characteristic of this type of disease, which cause the gait and balance of the older adult to become unstable, thus making them more prone to fall episodes.

Several studies have highlighted that most falls occur at home[5,16], however, do not reveal whether they result in TBI or TSCI. One of the factors that may contribute to falls in the home is the lack of adaptation of the environment for the older adult, with slippery floors, carpets and stairs, that is, the changes and limitations inherent in aging are not taken into account.

Same-level falls may be related to the both physical changes and limitations of aging. Associating these factors with the home indicates the need for greater performance of the primary health care team,

represented by the members of the Family Health Strategy, with a view to identifying environmental factors that favor the occurrence of falls and also guiding the older adults and residents regarding the proper management of these factors, such as in the case of carpets. In addition, it is also possible to intervene or promote preventive education concerning individual daily practices that should be avoided, as they contribute to falls, for example, walking about indoors in the dark.

Regarding the continuously used medication of the older adults that fell, there was no association between medication use and falling, considering that the use of medication followed the same pattern among all the older adults, that is, the majority of the patients with TBI/TSCI did not make use of the various classes of medication mentioned. Several authors have reported that falls suffered by older adults are directly related to chronic diseases and polypharmacy, which interfere with the respiratory and hemodynamic conditions of the older adult, sometimes masking the severity of the trauma and initiating hypoperfusion and hypoxia conditions[25]. As well as polypharmacy, incorrect adherence, drug interactions and adverse effects should be analyzed in the older adult.

Although the influence of the use of medications on the occurrence of TBI/TSCI was not identified in this study, this practice is considered an important risk factor for falls in older adults, especially when the medications are for cardiovascular diseases, insulin, anti-inflammatory non-steroids and antiepileptics, due to their cumulative side effects, interaction with other drugs or orthostatic hypotension[3]. Therefore, the use of these medications should be strictly guided by the doctor and accompanied by health providers.

The limitations of this study included the small population and the absence of the registration of the information in the medical records.

CONCLUSION

The characteristics of the trauma suffered by older adults are well established and the most frequent cause of trauma is same-level falls, especially among women. In this scenario, the incidence of injuries such as TBI and TSCI is high and may negatively impact the quality of life of the older adults and their family members and burden the health system.

In this study it was verified that the older adults with TBI/TSCI arrived at the hospital by specialized transportation. Patients classified as being less urgent (green) did not have TBI/TSCI, however, the absence of association of TBI/TSCI with the emergency (red) classification may be due to the limited hours of operation of the RASS or the worsening of the condition after the risk assessment. Although no statistical difference was verified, the proportion of deaths was higher among the patients who had TBI/TSCI. While the physiological changes of aging make older adults more susceptible to falling and poor prognoses, in this study there was no increase in the length of hospitalization.

This information is of great importance for public health, for the elaboration of strategies directed toward educational and preventive measures, either individually or collectively, that integrate policies in order to reduce the incidence of trauma suffered by older adults and decrease the morbidity and mortality.

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