Artigo Original

SEVERE INJURIES FROM FALLS ON THE SAME LEVEL

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ABSTRACT

Objective. Assess characteristics of trauma patients who sustained falls from their own height, more specifically focusing on presence of severe injuries, their diagnosis and treatment.

Methods. Retrospective study including all adult blunt trauma patients aged 13 or more admitted in the emergency room in a period of 9 months. Lesions with AIS (Abbreviated Injury Scale)>3 were considered "severe". Variables were compared between victims of fall from the same level (group I) and other blunt trauma mechanisms (group II). Student's t, chi square and Fisher exact tests were used for statistical analysis, considering $p<0.05$ as significant.

Results. Of the 1993 trauma patients included, 305 (15%) were victims of falls from the same level. In group I, mean age was 52.2 ± 20.8 years and 64.8% were male. Injuries in the head segment were the most frequently observed (62.2%), followed by injuries in the extremities (22.3%), thorax (1.3%) and abdomen (0.7%). Severe injuries (AIS^{3}3) were more frequent in the head (8.9%), followed by extremities (4,9%). In group I, craniotomies were needed in 2.3%. By comparing groups, we observed that victims of falls from the same level had significantly higher mean age, higher mean systolic blood pressure, and higher mean head AIS, as well as lower mean ISS, mean thorax AIS, mean abdomen AIS and mean extremities AIS.

Conclusion. Importance of the trauma mechanism in victims of falls from the same level should be emphasized due to a considerable possibility of hidden severe injuries, mainly in the cephalic segment.

Key Words: Closed head injuries. Multiple trauma. Trauma severity indices. wounds and injuries. Traumatology. Accidental falls.

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Introduction

Falls on the same level (FSL) are regarded as a public health problem, due to their high frequency and duo to their direct and indirect effects on the health of the population.[1,2] Although they are most common among the elderly, FSL also affect the epilleptic, chronic alcoholics and drug addicts. They can cause severe and life-threatening injuries, in addition to deteriorating previous morbid states, thus leading to late mortality.[3] Falls are often the result of several factors combined, and it is hard to narrow down the event of falling to one single risk factor or causing agent.[4]

Currently, about 15% of the patients admitted in specialized trauma centers suffered a FSL, thus consuming a significant portion of the resources allocated to health care. [4,5,6] It is estimated that, in 2000, approximately 19 billion dollard were spent in the USA treat FSL victims.[1] The incidence of falls increases with age, ranging from 34% among patients aged 65-80, 45% among patients aged 80-89 and 50% over 90 years old.[3] About half of these will fall again in the following 12 months.[1]

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This type of trauma is often neglected by paramedics for being a low kinetic energy mechanism. However, severe and potentially lethal injuries may present. The large majority of the studies available assesses only accidental falls in the elderly, but there is no reference to the injuries found in victims of FSL in general.[6,7,8] In spite of its importance, we have not found many studies that investigate the problem[9,10,11].

Therefore, the objective of this study is to assess the characteristics of FSL victims as compared to the victims of other blunt trauma mechanisms, as well as to compare the frequency of severe injuries, their diagnosis and treatments in each group.

Methods

This study was approved by the Ethics Committee for Research of Irmandade da Santa Casa de Misericórdia de São Paulo (project 008/10).

In the Emergency Room of Irmandade da Santa Casa de Misericórdia de São Paulo (ISCMSP), a prospective data collection is carried out with all trauma patients admitted into the ER since June, 2008. This protocol is initially filled out by the surgery residents at patient admission, and, later, by follow-up service attendants until discharge. The information is stored into an Access 2007® database.

In this study, we conducted a retrospective analysis of the protocols collected in the period from June 10, 2008 to March 10, 2009. All victims of blunt trauma aged 13 or more admitted into the Pronto Socorro Central Emergency Room whose trauma protocol had been correctly filled in were included in the study. Cases in which the trauma mechanism had not been described were excluded. Patients were divided into two groups: Group I: FSL victims; and Group II: victims of other blunt trauma mechanisms (automobile drivers and passengers, motorcycle riders and passengers, run over victims and victims of assault and level falls).

The groups were compared regarding the trauma mechanism, vital signs at admission, additional tests conducted, associated diseases, injuries diagnosed and their gravity, trauma rates and treatment. All variables listed in over 90% of the protocols were considered for analysis. The stratification of severity of the sample was carried out according to the trauma indexes Glasgow Coma Score (GCS)[12], Revised Trauma Score (RTS)[13], Abbreviated Injury Scale (AIS)[14], Injury Severity Score (ISS)[15] and computing the survival probability with the TRISS method.[16] Lesions with AIS $\geq$ 3 in the various body segments were considered to be "severe".[17] For instance, severe lesions in blunt trauma extremities include hip fractures, femur fractures, luxations of the knee, hip, wrist or ankle, amputation or crushing of the knee, tear of knee ligaments, laceration of the sciatic nerve, lesions of the femoral artery, trombosis of the popliteal or axillary artery or of the popliteal, axillary or femoral vein, as well as association with 2nd or 3rd degree burns encompassing over 20% of the body surface[14,17].

The statistical analysis was carried out using the Statistical Package for Social Sciences® (16.0). The numerical variables are presented as mean and standard deviation (when noted). We used the Student's t-test, the chi square test and the Fisher's test to compared the groups, considering the value of $p<0.05$ as statistically significant.

During this period, 2,059 trauma patients were admitted to the emergency room. From these, 66 had non-established

Table 1 – Trauma mechanism

Trauma mechanism	Number	%
Motorcycle rider or passenger	562	28.2%
Run over victim	460	23.2%
Falls on the same level	305	15.0%
Level falls	261	13.2%
Assault	220	10.8%
Driver of automobiles	185	9.6%
Total	**1993**	**100%**

Table 2 – Comparison of numerical variables between the groups

Variable	Group I N=305	Group II N=1688	p
Age	52.2 ± 20.82 years	35.4 ± 14.9 years	<0.001
SBP at admission	134.0 ± 21.2 mmHg	126.7 ± 23.4 mmHg	<0.001
HR at admission	82.2 ± 11.3 bpm	83.1 ± 14.1 bpm	<0.001
RR at admission	17.2 ± 3.3 ipm	17.2 ± 4.4 ipm	0.938
Glasgow at admission	14.2 ± 1.9	14.3 ± 2.3	0.659
Head AIS	0.92 ± 1.0	0.55 ± 1.1	<0.001
Thorax AIS	0.16 ± 0.2	0.20 ± 0.8	<0.001
Abdomen AIS	0	0.12 ± 0.6	<0.001
Extremities AIS	0.35 ± 0.8	1.11 ± 1.3	<0.001
RTS	7.68 ± 0.74	7.60 ± 1.03	0.155
ISS	2.71 ± 4.38	5.44 ± 8.77	<0.001
TRISS	0.98 ± 0.08	0.97 ± 0.12	0.233

SBP: systolic blood pressure. RR: respiratory rate. HR: heart rate. AIS: Abbreviated Injury Scale. RTS: Revised trauma score. ISS: Injury Severity Score. TRISS: computation of survival probability.

Table 3 – Comparison of nominal variables between the groups			
Variable	Group I N=305	Group II N=1688	p
Females	35.1%	24.7%	<0.001
Extradural bruise	2.6%	1.7%	0.274
Subdural bruise	1.6%	1.2%	0.523
Intraparenchymal bruise	0.3%	0.2%	0.744
Subarachnoid hemorrage	2%	1.7%	0.696
Cerebral contusion	5.6%	2.2%	0.001
Diffuse axonal injury	0%	1%	0.076
Brain swelling	0%	0.8%	0.117
Skull fracture	1%	2.2%	0.172
Face bone fracture	5.8%	4.6%	0.412
Craniotomy	2.3%	1.3%	0.155
Hemothorax	0%	2.1%	0.010
Pneumothorax	0%	2.5%	0.005
Flail chest	0%	1.3%	0.049
Pulmonary contusion	0%	2.2%	0.009
Thoracic drainage	0%	2.7%	0.003
Thoracotomy	0%	0.2%	0.404
Liver injuries	0%	1.3%	0.543
Spleen injuries	0%	1.5%	0.333
Kidney injuries	0%	0.5%	0.883
Hip fractures	0.3%	2.5%	0.018
Fracture of the upper limb	0.7%	5.6%	<0.001
Fracture of the lower limb	2.3%	5.5%	0.017
Exposed fracture of the upper limb	0%	1.4%	0.040
Exposed fracture of the lower limb	0%	4.1%	<0.001
Severe injuries (AIS>3) in cranium	8.9%	7.6%	0.467
Severe injuries (AIS>3) in thorax	0.3%	4.3%	<0.001
Severe injuries (AIS>3) in abdomen	0%	2.8%	0.003
Severe injuries (AIS>3) in extremities	4.9%	17.0%	<0.001

trauma mechanisms, thus leaving 1993 for the analysis. The most frequently observed trauma mechanism involved motorcycle riders (28.2%) (Table 1). Three hundred and five patients (15.0%) had suffered FSL. In Group I, age ranged from 13 to 99 years (52.2 ± 20.8 years), and 198 patients were male (64.9%). Ninety-eight (32.1%) victims of FSL were aged 60 or more. In Group II, age ranged from 13 to 91 years (35.4 ± 14.9 years), and 1,271 patients were male (75.3%).

Results

When comparing the groups, we observed that Group I presented significantly higher mean age (52.2 ± 20.8 years versus 35.4 ±14.9 years; p<0.001) and systolic blood pressure (134.0 ±21.2 mmHg versus 126.7 ± 23.4 mmHg; p<0.001) than those observed in Group II (Table 2). Mean AIS in cephalic segment was significantly higher in Group I (0.92 ±1.0 versus 0.55± 1.1; p<0.001) (Table 2). Mean severity rates in thorax (0.16± 0.2 versus 0.20 ±0.8; p<0.001), abdomen (0 versus 0.12± 0.6; p<0.001) and extremities (0.35± 0.8 versus 1.11± 1.3; p<0.001) were significantly higher in Group II. The ISS anatomical injury severity score was significantly lower in Group I (2.7 ±4.4 versus 5.4± 8.8; p<0.001). There was no significant difference in the comparison between the groups regarding the mean values for the RTS physiological score and the survival probability computed with the TRISS method (Table 2).

In victims of FSL (Group I), the cephalic segment injuries were most commonly found (62.2%), followed by extremity injuries (22.3%), thoracic injuries (1.3%) and abdominal injuries (0.7%). Cerebral contusions (5.6%) and extradural bruises (2.6%) were the most frequent severe injuries in cephalic region (Table 3). When compared to Group II, the patients of Group I presented a higher frequency cerebral contusions (5.6% versus 2.2%; p<0.001), as well as a lower frequency of hemothorax (0 versus 2.1%; p=0.005), pneumothorax (0 versus 2.5%; p=0,005), flail chest (0 versus 1.3 %; p=0.049), pulmonary contusion (0 versus 2.2%; p=0.009), pelvis fracture (0.3% versus 2.5%; p=0.018), fracture of the upper limb (0.7% versus 5.6%; p<0.001), fracture of the lower limb (2.3% versus 5.5%; p=0.017), exposed fracture of the upper limb (0 versus 1.4%; p=0.040) and exposed fracture of the lower limb (0 versus 4.1%; p<0.001) (Table 3).

Severe cephalic segment injuries were more frequent in Group I, but were not statistically significant (8.9% versus 7.6%; p=0.467). Both in the thoracic segment and in the extremities, severe lesions were significantly more frequent in Group II (0.3% versus 4.3%; p<0.001 and 4.9%; versus 17.0% p<0.001, respectively) (Table 3). Craniotomy was required in 2.3% of FSL victims and in 1.3% of remaining patients.

Discussion

Most studies about falls are focused on the elderly[1,18-24]. Data from the Centers of Disease Control report an investment of about US$ 24,900,000 in only 20 years to study and prevent falls among the elderly in the United States of America[19]. Several studies assess the risk of falling among the elderly, as well as its prevention[20-24]. Most falls among the elderly take place at home and relapse is a problem[23].

The greatest risk group are the elderly who make continued use of four or more medications and have had a previous fall[20,25]. The mortality rate due to falling after age 85 can reach 136.5/100,000, which corresponds to three times the rate observed in elderly patients aged 75 to 84[18]. In spite of some debate, prevention programs seem to have positive effect, but their application is difficult.[19,21,26-30]

However, we have observed, in our date, that only 32.1% of FSL victims are aged over 60. In spite of its severity among the elderly, this trauma mechanism involves a greater number of patients with their own characteristics. The problem seems to be much more far-reaching, as suggested by the severe and life-threatening injuries observed. There are probably other risk factors involved, such as drug and alcohol use, as well as the presence of seizures and lipothymia, although such data has not been analyzed in our study. This information points to the importance of prevention and education programs for the population and to the need for further research on the topic.

Our motivation to conduct this study was the observation of the large number of victims of this trauma mechanism, the real possibility of severe injuries associated to it, and the lack of research on the topic in the literature. In a period of nine months, 305 victims of FSL were admitted in our service; from these, about 8.9% presented severe cranial injuries and 4.9% presented severe extremity injuries. We underscore that this frequency of injuries is characteristic of this group, in which only adult trauma patients admitted to the emergency room were included. Most of these patients are brought to the hospital with some kind of pre-hospital care. In 2006, Schwendimann et al. observed more severe injuries in 3.9% of FSL victims in a intrahospital environment.[31] The falls are also frequent in children, corresponding to 45% of emergency room visits (under five years old), although only 3% lead to admissions.[18]

Although severe injuries have been identified, most FSL victims presented with mild injuries. Mean RTS and ISS showed trauma without compromise of the physiological state and with little anatomical involvement. The mean survival probability (TRISS) of 98% also showed that, in most cases, FSL victims present with mild trauma.

The definition of severe injuries in this study (AIS$\geq$3) involves those that require specific treatment and which could definitely influence the prognosis unless they are identified and treated.[17] There were also other patients with identified lesions, but lower AIS (Table 3). Although extremities were frequently involved, the largest number of severe injuries was identified in the cranial segment. This is extremely important, once some potentially lethal intracranial injuries could present with minimum symptoms at admission, and computerized tomography is the only way to obtain an early diagnosis. Less experienced physicians, when faced with an FSL victim, may underestimate minor signs and eventually miss the opportunity of diagnosing severe injuries.

The low frequency of these injuries could be a problem. In our study, about 2.6% of patients presented with extradural bruises and 5.6% presented with cerebral contusions. These injuries could go unnoticed initially, with the possibility of deteriorating hours later. If this occurs after discharge from the hospital, it could result in grim consequences for the patient and the medical team. This problem could also occur with orthopedic injuries, especially when the patient presents with impaired consciousness or lacks orientation to express their complaints. In our study involving general FSL victims, fractures were diagnosed in 3% of the cases.

We observed important differences in the comparison between Groups I and II, which points to characteristics that are specific of FSL victims. The greater number of elderly patients among FSL victims was accountable for the difference in mean age between the groups. This might also explain the greater frequency of females in this group. The comparison between the anatomical trauma scores (ISS) shows that FSL victims present less severe injuries. However, we observed a greater mean AIS in cephalic segment among the patients in Group I, which, again, points to the problem of cranioencephalic trauma among victims of this type of trauma. An interesting observation is that the need for craniotomy was approximately doubled in Group I, although there was no statistically significant difference.

Although we found few severe injuries in the thorax and abdomen, we understand that these can happen, even if not as frequently, in FSL victims. The fact that these lesions were not observed in our study is probably due to the size of our sample.

A general assessment of our data points to the frequency of FSL and to the possibility of complications associated with injuries that are not initially diagnosed. The underestimation of this trauma mechanism and the possibility of clinically hidden severe injuries could result in worse prognosis. The problem is considerable in the elderly, but not exclusive of this age group. There is a need for specific prevention projects, as well as new, focused studies on the topic.

Conclusion

Awareness of the trauma mechanism in FSL victims is of the utmost importance, given the possibility of clinically hidden severe injuries, especially in the cephalic segment.

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