Epidemiological evaluation of victims of spinal cord injury

Avaliação epidemiológica dos pacientes vítimas de traumatismo raquimedular

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A B S T R A C T

Objective: to evaluate patients suffering from spinal cord injury **Methods**: A retrospective, cross-sectional study was conducted with 87 patients admitted to the university hospital of UFMA between January 2008 and June 2009. We assessed sex, age, compromised segment of the spine and cause of injury, subjecting these data to statistical analysis (chi-square test). **Results**: there was a significant prevalence of males ($p < 0.001$), with 81.6% (71) cases, and age between 21 and 30 years of age ($p < 0.001$), with 39.1% (34) of cases. The average age was 33.96 ± 13.56 years. The proportion of falls from height was significantly greater than the number of traffic ($p < 0.001$) and motorcycle ($p < 0.001$) accidents. The most compromised segment of the spine ($p < 0.001$) was the thoracic (33), with 37.9% of cases. Traffic accidents appear in greater proportion among men ($p = 0.014$). The cervical spine was the most affected in males ($p = 0.043$). The thoracolumbar fractures were caused, to a greater extent, by falls from height ($p = 0.003$), whereas involvement of the thoracic spine was significantly higher ($p = 0.016$) in traffic accidents. **Conclusion**: The group at higher risk of injury to the spinal cord is the young adult male. Although there is a difference between the sexes when correlated traffic accidents, falling from height is the main cause in both sexes.

Key words: Spinal cord. Injuries to the spinal cord. Epidemiology. Neurosurgery.

INTRODUCTION

Trauma is an important external cause of morbidity and mortality, especially among the younger population. At the age range from five to 39 years external causes, such as traffic accidents, falls and interpersonal violence are the first causes of death. Traffic accidents and homicides together account for more than half the number of deaths[1]. Among the types of trauma, spinal cord represents a significant cause of morbidity and mortality worldwide[2].

Spinal cord injury (SCI) is deemed any external cause of injury to the spine, including whether or not the spinal cord or nerve roots, in any of its segments. Its worldwide incidence is estimated between nine and 50 cases / one million inhabitants, being more prevalent in urban areas. In 2004 The Brazilian Unified Health System (SUS) recorded 15,700 admissions for such injuries, with 505 deaths from spine fractures, which usually mean prolonged and costly hospital stays and involve a multidisciplinary team. They cause serious neurological and psychological sequelae, as well as in the household economy and civil society, since they primarily affect patients in a professional, productive age[3].

The spinal injury occurs predominantly in males, a ratio of 4:1, aged between 15 and 40 years. Automobile accidents, falls, diving accidents through shallow water and gunshot wounds are the main causes of SCI[4]. Therefore, the epidemiological information may show differences in the incidence of SCI and its individual and social implications, in order to help to program material and physical resources needed to treat and predict the outcome of therapy and prognosis of trauma, as well as - and above all - its prevention[5].

So there is need for new epidemiological studies to identify and characterize patients with SCI, since this condition is not subject to compulsory notification, resulting in scarcity of studies about the epidemiology of SCI in Brazil.

In the present study, the aim is to identify and characterize - by sex, age, committed spine segment and causes - the patients undergoing spine surgery with diagnosis of SCI.

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METHODS

We conducted a retrospective cross-sectional study with 118 medical records review, at the Medical Records Service, of patients undergoing the spine surgery. Of this total, 31 were excluded for not having the SCI clinical and radiological diagnosis confirmed by computed tomography and / or magnetic resonance imaging, resulting in 87 patients.

After selection, we identified the following variables in the records: sex, age, compromised segment of the spine and cause of trauma, whether due to traffic accidents, falls in general (not specifying the height), fire arms or diving in shallow water.

Data were expressed with their respective confidence intervals. Statistical analysis was performed with SPSS version 11.5. To compare proportions we used the chi-squared test with significance level of 5% when crossed variables: age and sex, cause and sex, sector and sex, cause and age group, stratum and age group and, at last, cause and segment.

RESULTS

In the 87 selected patients, in relation to socio-demographic variables, only age and sex were recorded in all charts.

In this sample, 81.6% (71) of patients were male with 39.1% (34) between 21 and 30 years of age (p <0.001). For the other age groups cross each other, the p value was greater than 5%, so that the observed differences are not statistically significant (Table 1).

The mean age was 33.96 ± 13.56 years, with variance between eight and 72 years, and the sample showed a bimodal distribution, with five patients with 24 years and five patients with 29 years.

Regarding the causes of trauma, we observed a higher frequency of the item "falls in general", with 42.6% (37), followed by motor vehicle accidents with 41.4% (36). It is noteworthy that this variable, the overall proportion of falls was significantly higher than that of automobile accidents (p <0.001) and motorcycle (p <0.001) when they were individualized. The frequency of accidents (24.2%-21) was significantly (p = 0.016) higher than that of motorcycle accidents, 17.2% (15) (Table 2). The most affected segments were the dorsal in 37.9% (33), followed by cervical and lumbar spine, respectively with 26.4% (23) and 25.4% (22), their differences being statistically significant (p <0.001) (Table 2).

When we crossed gender with causes, it was observed that traffic accidents appear in greater proportion among men (p = 0.014). Among automobile accidents, those involving cars were also more prevalent in males (p = 0.007) (Table 3).

We also observed that the cervical spine was most affected in males (p = 0.043) and there is no statistical difference when the other segments were crossed with gender (p> 0.05) (Table 4).

When related to the segment of the spine committed to the cause, it was found that thoracolumbar fractures were caused, to a greater extent, by falls in general (P = 0.003), whereas involvement of the thoracic spine is significantly higher (p = 0.016) in traffic accidents (Table 5).

The crossings age- gender, cause-age and segment-age displayed no statistically significant differences (p> 5%).

DISCUSSION

Due to its abrupt and unexpected installation, with potential to cause sequelae such as paraplegia and quadriplegia, and its preference for individuals at the peak of their productivity, SCI represents a major public health problem worldwide.

For every million inhabitants, 17 new SCI cases occur in Germany and 32 to 52 new cases annually in the U.S.[6]. In Brazil, there are about 71 new cases per million inhabitants[7].

In this work male gender prevailed – 87 patients, 81.6% (p <0.001), in accordance to the ratio of 4:1. This is corroborated by other studies on SCI prevalence[8-16].

In a specialized trauma center in Canada[17], as well as in evaluations conducted in the eastern zone São Paulo city (Brazil)[18] it has been observed an increased prevalence of SCI in women, to about 30%. These data can be directly related to the fact that the women are

Table 1 - Distribution of patients suffering from spinal cord injury according to gender and age group.

Variables	f (%)	p
Gender		
Male	71 (81.6)	<0.001
Female	16 (18.4)	
Age (in years)		
01 – 10	1 (1.1)	>0.05
11 – 20	8 (9.2)	>0.05
21 – 30	34 (39.1)	<0.05*
31 – 40	20 (23.0)	>0.05
41 – 50	10 (11.5)	>0.05
51 – 60	11 (12.6)	>0.05
61 or more	3 (3.5)	>0.05
Total	87 (100)	-

Source: patients' records of the HUPD Neurosurgery Service, São Luís, Maranhão – MA, January 2008 to June 2009.

** crossing of age range 21-30 years with the following: 11-20 (p = 0.017); 31-40 (p = p < 0.001); 41-50 (p = 0.007); 51-60 (p = 0.004)*

Table 2 - Distribution of patients suffering from spinal cord injury according to the cause and the compromised spine segment.

Variable	F (%)	p
Cause		
Falls in General	37 (42.6)	<0.001[1]
Traffic accidents	36 (41.4)	>0.05[2]
Automobile	21 (24.2)	0.016[3]
Motorcycle	15 (17.2)	
Perf. by firearm	11 (12.6)	>0.05
Diving in shallow waters	3 (3.4)	>0.05
Segment		
Thoracic	33 (37.9)	<0.001
Cervical	23 (26.4)	<0.001
Lumbar	22 (25.4)	<0.001
Toracolombar Transition	9 (10.3)	<0.001
Total	87 (100)	-

Source: patients' records of the HUPD Neurosurgery Service, São Luís, Maranhão – MA, January 2008 to June 2009.

1. p < 0.001 when crossed: General falls with automobile accidents and motorcycle accidents, separately.

2. p > 0.05 when crossed: General falls with traffic accidents

3. p = 0.016 when crossed: automobile accidents with motorcycle accidents.

carrying more vehicles (motorcycles, cars), as well as being professionally more inserted in civilian buildings, where falls are more frequent.

In relation to age, this survey shows that it ranged from eight to 72 years, mean 33.9 ± 13.5 years, in line with other studies[10,12,15,16].

Other works[14,18] found an average age five to six years above the one of this study. In Paraná[19], the average age was 25 years. However, this study evaluated if only those patients who suffered SCI by firearms, not taking other causes into account. Hence it is inferred that violent causes - among them, interpersonal violence - such as firearms, was more common in young adults and particularly among men (95.5%)[19].

In dealing specifically with age,[9,13,14] there is agreement on a higher prevalence of SCI between 21 and 30 years of age, as consistent with this study[8,11]. In others there is a greater prevalence of SCI in the ranges from 21 to 40 and from 21 to 35 years, respectively, with 45% and 50%. In the same sense, it was here found 62.1% of patients between 21 and 40 years old. Anyway, the socioeconomic impact of the SCI is clear, since it concentrates primarily on the economically active individuals in the prime of their integration into society, which represents economic, social, family and psychological burden for patients / family and for public health.

Falls in general (42.6%), traffic accidents (41.4%), perforation by firearms (12.6%) and diving into shallow

Table 3 - Distribution of the number of cases of traumatic spinal injury by gender and cause.

	Cause			
	General outages	Traffic accidents	Drilling by firearm	Diving in shallow water
	f(%)	f(%)	f(%)	f(%)
Gender				
Male	33 (89.1)	25 (69.4)[1]	10 (90.9)	3 (100)
Female	4 (10.9)	11 (30.6)[1]	1 (9.1)	0 (0.0)
Total	37 (100)	36 (100)	11 (100)	3 (100)

Source: patients' records of the HUPD Neurosurgery Service, São Luís, Maranhão – MA, January 2008 to June 2009.

p > 0.05 on all crossings, except in note 1

1. p = 0.014 when crossed: gender with traffic accidents, including with p = 0.007 when crossed gender and automobile accidents.

Table 4 - Distribution of the number of cases of traumatic spinal injury by gender and compromised spine segment.

	Segment			
	Cervical f(%)	Thoracic f(%)	Trans. TL* f(%)	Lumbar f(%)
Gender				
Male	22 (95.6)[1]	25 (75.7)	9 (100)	15 (68.1)
Female	1 (4.4)[1]	8 (24.3)	0 (0.0)	7 (31.9)
Total	23 (100)	33 (100)	9 (100)	22 (100)

Source: patients' records of the HUPD Neurosurgery Service, São Luís, Maranhão – MA, January 2008 to June 2009.

** Trans. TL = toracolombar transition*

p > 0.05 on all crossings, except in note 1

1 p = 0.043 when crossed: gender and cervical segment

Table 5 - Distribution of the number of cases of traumatic spinal injury by cause and compromised spine segment.

	Segment			
	Cervical f(%)	Thoracic f(%)	Trans. TL* f(%)	Lumbar f(%)
Cause				
Falls	11 (47.8)	10 (30.3)	8 (88.9)[1]	8 (36.4)
Traffic accidents	10 (43.4)	19 (57.5)[2]	0 (0.0)	7 (31.8)
Firearm	0 (0.0)	3 (9.0)	1 (11.1)	7 (31.8)
Diving in shallow waters	2 (8.8)	1 (3.2)	0 (0.0)	0 (0.0)
Total	23 (100)	33 (100)	9 (100)	22 (100)

Source: patients' records of the HUPD Neurosurgery Service, São Luís, Maranhão – MA, January 2008 to June 2009.

p > 5% on all crossings, except in notes 1 and 2

1. p = 0.003 when crossed falls and toracolombar segment

2. p = 0.016 when crossed traffic accidents and thoracic segment

water (3.4%) were the main causes of SCI found in this study. In the Santa Marcelina Hospital, Sao Paulo eastern zone[18], with 100 patients with thoracolumbar fractures, the overall frequency of falls (78%) was significantly higher than motor vehicle accidents (car and motorcycle summing 20%). This study showed that, of 78 falls, 75 were falls from the roof.

In this research it was not possible to assess the height or location of the crash, by lack of these records in the charts.

It is noticed that in prevalence studies in southeastern Brazil [2,8,9,18] falls from the roof are of particular importance, mainly because they happen in poverty areas, where the vertical growth, embodied in the construction of houses in the slums, ultimately makes the slab roofs a kind of backyard, where meetings / celebrations happen (party venue).

Also with regard to the causes of SCI, other studies[10,15,16] reverse the pattern of distribution. A study[10] with 25 victims of the SCI in the Regional University Hospital of Northern Paraná shows that 50% were due to automobile accidents, 20.8% firearms perforations, 12.5% due to stab wounds and 8.3% for sequelae of surgical procedures - the only study in which spine operation was identified as a cause of spinal cord injury.

Two studies, one conducted in the Paraíba Valley[15] and another in Curitiba[16], draw attention to firearms incidents as the main cause of SCI, around 45% of total cases in both studies. This demonstrates that in large urban centers interpersonal violence plays an important role. Finally, diving in shallow water in the sample of HUPD and other studies[2,8,9,12,15] oscillates as the third to fifth cause of SCI, ranging in frequency from 1.2% to 10%.

In the present study, the thoracic segment was significantly more affected than others ($p < 0.05$), followed by cervical and lumbar ones. Other works point to the same results[12,15,20]. In Santo André city, São Paulo State[8], however, a study of 100 patients between 2003 and 2006 observed reversal of this pattern, with prevalence of the cervical, lumbar and thoracic segments, respectively.

When we crossed the variables, it was noted that traffic accidents - more precisely those involving cars - are significantly more frequent among men. However, there was no significant difference between the genders when considering only motorcycle accidents (p> 0.05).

Another study[18] reports that the proportion of motorcycle accidents among males is significantly higher, while the proportion of accidents with cars is significantly lower (p = 0.009). These inferences may be related to the fact that women are driving more and therefore end up being exposed to car accidents to a greater degree, and also the fact that the majority of motorcyclists are men.

Campos *et al*.[9] crossed gender and age and found that 86% of spinal cord injuries occurred in men, predominantly in young people, and slightly more than 40% of the accidents occurred in people under 30 years of both genders. In the HUPD series no significant differences were found for this crossing.

In this study, we observed that the cervical spine is most affected in males (p = 0.043) and there is no statistical difference with the other segments when crossed with gender (p> 0.05). In contrast, Fields *et al*.[9] found no significant differences for this intersection (p> 0.05). Men, therefore, are more likely than women to quadriplegia.

In the HUPD series, when the committed spine segment was crossed with the cause, it was found that thoracolumbar fractures are caused in mostly (p = 0.003) by falls in general, while involvement of the thoracic spine is significantly higher (p = 0.016) in traffic accidents. The other crossings between causes and segments were not significant. Campos *et al*.[9] did not apply statistical tests for this intersection. No other work applying this crossing was found.

In the crossings cause-age and segment-age all p values were greater than 5%, in agreement with the studies of Fields *et al*. [9] and Rodrigues *et al*. [18]. There were no other studies, besides those already mentioned, which made crosses between the variables.

Therefore, one should target prevention campaigns both to reduce the occurrence of automobile accidents and to decrease the incidence of falls. For the latter case, the first step should be a survey of the situations in which accidents occur from falling. At first, arise the preventive home care to elderly (risk for falls on the same level) and use of personal protective equipment for workers in civil construction or for those who climb trees. For motor vehicle accidents, ther should be more effort into the monitoring of traffic rules, as well as insisting on the awareness of drivers. The expenditure will be much lower if the target is prevention, rather than being directed to cover the costs of hospitalizations, operations, rehabilitation and social security.

Men between 20 and 30 years of age are most vulnerable to the SCI. There is a difference between the genders when correlated with traffic accidents. Falls from height are the main cause of SCI in both sexes. In addition, the thoracic and cervical segments figure as the most committed, which means higher risk of paraplegia and quadriplegia.

R E S U M O

Objetivo: *Fazer avaliação epidemiológica de 87 pacientes vítimas de traumatismo da medula espinhal, internados no hospital universitário da UFMA entre Janeiro de 2008 e Junho de 2009.* ***Métodos:*** *Estudo transversal retrospectivo, segundo: sexo; idade; segmento da coluna comprometido e causa do traumatismo, submetendo estes dados à análise estatística (teste do quiquadrado).* ***Resultados:*** *predomínio significativo (p<0,001) do sexo masculino, com 81,6% (71) dos casos, e da faixa etária entre 21 e 30 anos de idade (p<0,001), com 39,1% (34) dos casos. A média de idade foi 33,96±13,56 anos. A proporção de quedas de altura foi significativamente maior do que a dos acidentes automobilísticos (p<0,001) e motociclísticos (p<0,001). O segmento da coluna significativamente (p<0,001) mais comprometido foi o torácico 37,9% (33) dos casos. Os acidentes de trânsito aparecem em maior proporção entre os homens (p=0,014). A coluna cervical foi mais acometida no sexo masculino (p=0,043). As fraturas toracolombares foram provocadas, em maior proporção, pelas quedas de altura (p=0,003), enquanto que acometimento da coluna torácica é significativamente maior (p=0,016) nos acidentes de trânsito.* ***Conclusão:*** *o grupo de maior risco para o traumatismo da coluna espinhal é o de adultos jovens masculinos. Apesar de existir uma diferença entre os sexos quando se correlacionam os acidentes de trânsito, a queda de altura é a principal causa em ambos os sexos.*

Descritores*: Medula espinhal. Traumatismos da medula espinhal. Epidemiologia. Neurocirurgia.*

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