EPIDEMIOLOGICAL STUDY OF TRAUMATIC SPINAL CORD INJURY IN GOIÂNIA

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ABSTRACT
Purpose: Spinal cord injuries are a growing cause of morbidity and mortality in the population. Studies on etiology and aggravation of this trauma are critical to subsidize health policies for this population. This study aimed to describe the epidemiological profile of patients with spinal cord injury in Goiânia, Goiás, Brazil. Methods: Epidemiological study with documental analysis of 265 cases of spinal cord injury treated at the Emergency Hospital of Goiania in 2013. Results: The trauma was prevalent in male young people. The main cause was traffic accidents. The thoracolumbar region was the most affected. Half of the patients showed no spinal cord injury, but 52.45% presented some motor deficit. Treatment was conservative in most cases. In 109 patients required surgery due to trauma associated with being the head trauma the most frequent. Mortality was 14% and the highest risk of death occurred in cases aged under 60 years, cervical spine trauma and complete spinal cord injury. The average hospital stay was 6 days and was higher in surgical patients. All patients were seen by the Unified Health System, generating a cost of R$756,449.37. Conclusion: These findings allow guidance on efficient allocation of resources for the management of these diseases and indicate the need to create targeted strategies to prevent this type of injury in this population.

Keywords: Spinal cord injury; Epidemiology; External causes.

RESUMO
Objetivo: Os traumatismos raquimedulares constituem crescente causa de morbimortalidade na população. Estudos sobre etiologia e agravos desse trauma são fundamentais para subsidiar políticas de saúde para essa população. Este estudo teve como objetivo descrever o perfil epidemiológico de pacientes com trauma raquimedular em Goiânia, Goiás, Brasil. Metodologia: Estudo epidemiológico com análise documental de 265 casos de trauma raquimedular atendidos no Hospital de Urgências de Goiânia, em 2013. Resultados: O trauma foi predominante em jovens do sexo masculino. A principal etiologia foi acidente de trânsito. A região tóraco-lombar foi a mais atingida. Metade dos pacientes não apresentou lesão medular, porém 52,45% apresentaram algum déficit motor. O tratamento foi conservador na maioria dos casos. Em 109 pacientes houve necessidade de cirurgia devido a traumas associados, sendo o trauma crânio-encefálico o mais frequente. A mortalidade foi de 14% e o maior risco de óbito ocorreu nos casos com idade inferior a 60 anos, trauma da coluna cervical e lesão completa da medula espinhal. A permanência hospitalar média foi de 6 dias, sendo maior em pacientes cirúrgicos. Todos os pacientes foram atendidos pelo Sistema Único de Saúde, gerando um custo de R$756.449,37. Conclusão: Os achados permitem a orientação quanto a alocação eficiente de recursos para o manejo desses agravos e indicam a necessidade de criação de estratégias orientadas para a prevenção desse tipo de lesão na população estudada.

Palavras-chave: Lesão medular; Epidemiologia; Causas externas.

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INTRODUCTION

Traumatic spinal cord injury (TSCI) is a lesion of external cause in the spine that may reach the cord or nerve roots in any segment[1]. Its prevalence is related to increasing urbanization, which has consequences such as violence and traffic accidents[2]. So, it's sharp and unexpected event.

The signs and symptoms are shown in different ways, depending on the affected vertebral level and the degree of spine involvement. It can result in motor, sensory and autonomic dysfunction[1,2]. These consequences can significantly interfere in the quality of life of these victims[3].

There is wide variation in incidence and prevalence of TSCI among world geographic regions, but it is consensus that these rates have increased alarmingly in recent decades[2,4].

Considering the above, and because of great socioeconomic impact of this damage, this study aims to analyze the epidemiology of TSCI in patients from a referral terciary level hospital in Goiânia, Goiás.

METHODS

This is a retrospective cross-sectional series of cases. It was analised medical records of patients admitted to a public high and medium complexity in emergency care hospital in Goiânia with diagnosis of TSCI confirmed by imaging exams (computed tomography and/or magnetic resonance imaging), in 2013.

Social-demografic and clinical characteristics of patients were assessed through a specific form. Data were analyzed by descritive and analitical statistical program. Association among numeric variables was assessed using Chi-square test, Chi-square with exact significance of Fisher test and Mann Whitney test. All statistical tests were performed at a significance level of 0.05.

This study was approved by the Research Ethics Committee of the State University of Campinas/SP (UNICAMP), Brazil. There are no conflicts of interest in this research.

RESULTS

This study comprised 265 cases. The sociodemographic characteristics of the sample are presented in Table 1.

Mean age was 32.1 years, ranging 4-87 years, mean 36.1 years, standard deviation of 16.5 years. The male-female ratio was 4.4:1.0.

Table 2 shows all the mechanisms of trauma found in the sample. Cases of traffic accidents and falls were categorized for better analysis and understanding of the determinants of TSCI.

Association of etiologic factors with sex demonstrated a statistically significant difference in the sub-types of falls ($p<0.001$), showing that fall from height were more frequent in females, while males most often found in falls roofs, scaffolding or ladder.

Table 1 – Sociodemographic data (n = 265)

AGE GROUP	**% (f)**	**OCCUPATION**	**% (f)**
0-20	18,90% (50)	Service providers	37,44% (100)
21-40	46,40% (123)	Students	9,06% (24)
41-60	24,20% (64)	Agricultural workers	7,17% (19)
≥ 61	9,40% (25)	Adm services	4,53% (12)
Uninformed	1,10% (3)	Others	4,90% (13)
ORIGIN	**% (f)**	Uninformed	36,60% (97)
Goiânia/metropolitan área	75,10% (199)	**MESOREGION***	**% (f)**
Interior of Goiás state	24,10% (64)	Center	80,99% (213)
Other states in Brazil	0,80% (2)	South	10,27% (27)
EDUCATION	**% (f)**	Northwest	4,94% (13)
Elementary School	32,83% (87)	North	2,66% (7)
High School	13,21% (35)	East	0,76% (2)
Graduation	2,26% (6)	Uninformed	0,38% (1)
Illiterate	1,13% (3)		
Uninformed	50,57% (134)		

*N=263

Table 2 - Distribution of etiology (n = 265)

ETIOLOGY	% (f)	TRAFFIC ACCIDENT	% (f)
Traffic accident	40,80% (108)	Motorcycle	67,60% (73)
Injury by firearm	22,60% (60)	Automobile	26,85% (29)
Falls	22,30% (59)	Bicycle	5,55% (6)
Running over	5,30% (14)	**TOTAL**	108
Physical assaults	3,00% (8)	**FALLS**	**% (f)**
Diving in shallow water	0,40% (1)	Roof, bridge, ladder or scaffold	55,93% (33)
Others	4,90% (13)	Fall from height	20,34% (12)
Uninformed	0,80% (2)	Horse, wagon or tree	18,64% (11)
TOTAL	265	Level drop	5,09% (3)
		TOTAL	59

In relation to the TSCI caused by traffic accidents, it was revealed a high frequency of victims with motorcycles, but there was no statistically significant difference between genders (p=0.755).

Association between sex and the prevalence of trauma caused by injury by firearm (IBF) in relation to other causes was also statistically significant (p=0.02), found higher prevalence of IBF in males. Results also showed that the only case of TSCI by diving in shallow water was a male patient who died.

The distribution of variables related to trauma and treatment for TSCI, is shown in Table 3.

Table 3 – Clinical data (n=265)

SPINAL LEVEL	% (f)	ASSOCIATED INJURY	% (f)
High cervical (C0-C2)	15,85% (42)	Traumatic brain injury	46,55% (81)
Low cervical (C3-C7)	25,66% (68)	Chest trauma	38,50% (67)
Thoracic (T1-T10)	26,04% (69)	Lower limbs trauma	29,88% (52)
Thoracolumbar (T11-L2)	29,43% (78)	Upper limbs trauma	20,69% (36)
Lumbar (L3-L5)	14,34% (38)	Abdomen trauma	19,96% (33)
Sacral (S0-S5)	5,28% (14)	Others	22,41% (39)
SPINAL CORD RUPTURE	**% (f)**	**ICU ADMISSION**	**% (f)**
No rupture	50,57% (134)	Yes	26,42% (70)
Total rupture	15,85% (42)	No	73,58% (195)
Parcial rupture	10,94% (29)	--	--
Uninformed	22,64% (60)	--	--
TREAT FOR SCI	**% (f)**	**MOTOR DEFICIT**	**% (f)**
Conservative	89,81% (238)	Yes	52,45% (139)
Surgical	8,30% (22)	No	46,42% (123)
Uninformed	1,89% (5)	Uninformed	1,13% (3)

With regard to cases of extravertebral associated trauma, it is important to note that 109 patients underwent surgery for these causes (41.13% of the total sample).

Mean of hospital stay was 6 days, ranging from 1 to 160 days. When comparing patients undergoing conservative and surgical treatment, this mean was 5 (minimum 1 and maximum of 160 days) and 15 days (minimum of 4 and maximum of 84), respectively, with a statistically significant difference between the groups (p=0.0001).

Regarding the completion of hospital care, the data indicated that most patients discharged from the hospital (63.60%).

Mortality ratio of the study was 14%. Other data regarding mortality are shown in table 4 and figure 1.

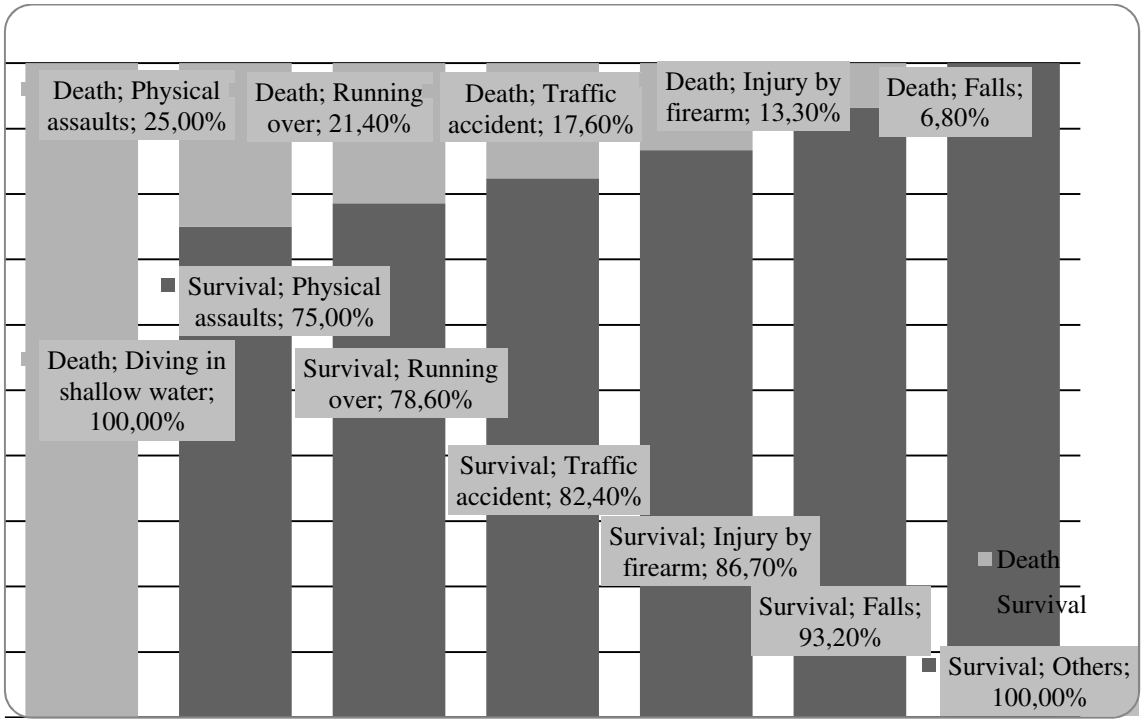
Table 4 – Mortality and survival by sociodemographic and clinical data (n=265)

VARIABLE	**Survival** (N=228) **% (f)**	**Death** (N=37) **% (f)**	**Chi-square test** ***(p)***
Male	84,70% (182)	15,30% (33)	*p=0,191*
Female	91,80% (45)	8,20% (04)	
< 60 years old	84,40% (200)	15,60% (37)	*p=0,031*
≥ 60 years old	100% (25)	0,0% (0)	
Cervical lesion	78,20% (79)	21,80% (22)	*p=0,018*
Thoracic lesion	91,20% (114)	8,80% (11)	
Lumbar or sacral lesion	88,60% (31)	11,40% (4)	
No SC rupture	92,50% (124)	7,50% (10)	*p=0,0003*
Parcial SC ruptute	96,60% (28)	3,40% (1)	
Total SC rupture	71,40% (30)	28,60% (12)	
ICU admission	53,20 (33)	46,80 (29)	*p<0,001*
No ICU admission	96,00 (192)	4,00 (8)	

SC = spinal Cord ICU = Intensive Care Unit

Total hospitalization cost was R$756.450,37, with mean of R$907,62 and median of R$ 2.943,57. When analyzed day cost it can be seen mean of R$139,12 and median of R$257,02. However, this value does not include plates and screws used for fixation of the spine of patients undergoing surgery, which significantly increase the total cost for Public Health System.

Figure 1 – Distribution of mortality and survival by etiology (N=263)



DISCUSSION

Demographic variables

Predominance of young adult male victims of TSCI had already well documented in literature[1,2,4-8]. In this study, it was also confirmed. Normally, males have a higher behavior risk than females[9]. However, research warn about increased incidence among females over the years, which reflects cultural and social trends change of their role in home and at work[5,7,10].

Mean age of patients and the highest frequency in the population were very similar to that reported in the study of Custodio et al.[11], also performed in a hospital in Goiânia, which predominated in males, mean age of 35.3.

This is an important issue, as this population is in a productive period of life, and its economically occupation is interrupted by injury. Thus, it falls as a major public health problem[12].

By observing low educational level of the individuals this problem becomes even more serious. This fact can be observed in other studies with TSCI patients in Brazil, suggesting that it is a national event[10,13]. Added to this, the predominant occupation in our study was trade and services providers. Thus, it is necessary to reflect on social and cultural patterns that perpetuate themselves in the middle studied.

Regarding the origin, data show the referential character that UHG presents as a state hospital to care of victims of TSCI. It also suggests the need to create new decentralized hospitals, since many patients came from the interior of Goiás (24.10%).

Etiology

Regarding etiology, findings are similar to those found in studies of Rahimi-Movaghar et al. [7], DeVivo[14] and Chiu et al. [15], in which main cause of TSCI is traffic accidents.

Goiânia has been titled as one of the Brazilian cities with the most violent traffic[16]. Explanations for this are numerous. The wide, flat streets and avenues that facilitate the acceleration of vehicles, coupled with the recklessness of drivers, increasing the number of circulating mobile vehicles and impunity resulting from poor monitoring are some of probable causes[11].

Also noteworthy is the number of motorcycle accidents. Morais et al.[13] argues that motorcyclists have most risk of dying or suffering injury to an occupant of a motor. In Goiás, this is a widely used vehicle because there is a predominance of dry weather during the year and few slopes in the streets.

In contrast to our data, some research of Brazilian populations shows falls as the main etiological factor of TSCI[5,8,17]. In these cases, however, there is a greater age of the sample. Moreover, these studies were conducted in the southeast and northeast of Brazil, where it is fairly common practice of irregular buildings used for celebration meetings.

As regards the type of fall, females are more likely to suffer high falls, while males have a higher risk of falling from the roof, scaffold or ladder. This fact may be explained by the higher occupational risk related to activities such as construction in male.

Another etiologic result that deserves to be discussed is the high frequency of IBF, more often involvement in males. This result can be found in other studies, in which Brazil is highlighted by its high rates of violence between civil society, causing great social concern[1,4,8,17,18].

Vertebral level affected

In relation to affected segments, thoracolumbar spine was slightly predominant, which Zaninelli et al.[19] explain occur due to abrupt change in fixed segment of the column (ribcage) for mobile segment (lumbar spine).

Depending on the study, this topography can vary. Morais et al.[13] and Bernardi[20] describe higher frequency of neck injuries. Authors suggest that traffic accidents result in greater cervical lesion index, while falls have higher frequency of thoracolumbar injury. However, in our study it was not confirmed.

Neurological impairment

With respect to the spinal cord involvement, the results point to the predominance of cases without neurological impairment. However, in cases where this impairment was present, entire lesion was more frequent than incomplete one, which has also been reported in studies cited in systematic review by Rahimi-Movaghar et al.[7] covering 64 scientific papers from 28 countries.

Treatment for TSCI

Treatment for TSCI was predominantly conservative, using classical methods such as bed rest, traction and stabilization orthotics. Surgical treatment was performed in a few cases and it consisted of implantation of screws and internal fixator. In some cases, root relief for pain relief was required.

Studies such as the Magellan et al.[21] and Pereira and Jesus[22] show that conservative treatment brings low risk of complications for patients and surgical approach should only be indicated in cases of misalignments and persistent compressions, or risk worsening due to instability.

Associated traumas

Presence of associated trauma is common in cases of TSCI, especially when the most common etiologies are traffic accidents, falls and IBF, because they are high-impact events[12,13,16]. In the present study, this finding is confirmed, including a large number of cases which required surgery.

Traumas that most affect patients in this study - traumatic brain injury (TBI), chest trauma and lower limbs trauma - reinforce what has been said above, evidencing the relationship of associated injuries with main etiologies.

According to Zaninelli et al.[19], about 25.00% of TSCI patients have at least mild TBI. Our sample had much higher frequency, indicating greater severity of accidents, leading to more serious injuries also.

Motor deficit

Information about motor impairment rating in medical records was difficult. Rating scales titled as gold standard in the evaluation of TSCI[1,3], such as scale of the American Spinal Injury Association (ASIA), Frankel and Functional Independence Measure (FIM), have not been used routinely, reducing the objectivity of neurological examination. Thus, patients who had a disability could had a functional limitation due to pain, without necessarily having a neurological impairment, or even an installed spinal cord involvement. However, almost 16.00% of cases with complete neurological lesions had this clear information recorded.

Intensive Care Unit (ICU)

Some patients require support in ICU for several causes. Indication occurred mainly in patients with polytrauma, since it requires various approaches treatments, which increases risk of complications and, therefore, makes the patients most unstable[23].

According to Santos et al.[24], the more severe neurological impairment the higher chance of patients have complications and require treatment in ICU. These authors state that neurological status is the most important morbidity and mortality risk factor.

Hospital stay

Mean hospitalization time related by Creôncio et al.[25] (17.8 days) was found resembling to our sample. Pereira and Jesus[22] found a slightly higher one (23 days).

According to Hagen[10], this time is variable between hospitals, and in specialized rehabilitation centers hospitalization can be much higher, reaching an mean of 67 days.

Touno[26] describes that mean length of hospital stay showed an increase over the years, and the level of injury and degree of spinal cord involvement interfere with long.

When comparing patients undergoing surgical and conservative treatment, findings of this research show that hospitalization time is longer when the surgical approach is necessary (about 10 days longer).

Some factors may be responsible for this, such as delay for exams, unavailability of the operating room or even materials such as plates and screws for fracture fixation, immediately.

Mortality

Mortality rate in our study was 14.00%, which coincides with the upper limit of what was found in other studies, ranging from 4.90% to 14.20%[10,22,25,27,28].

Association of mortality with variables showed that death is higher when trauma occurs in individuals under the age of 60 years, with involvement of the cervical spine and when the spinal cord injury is present. This result is in agreement with data found by Lalwani et al.[28], that describe group between 25 and 64 years as being more susceptible to death by TSCI.

Hasler et al.[12] and Morais et al.[13] also describe severity of lesion as a significant risk factor, with cervical involvement and complete lesion more likely to intra-hospital mortality, since they are most disabling and higher risk of complications lesions.

Regarding etiology, aggression proved to be a major cause of mortality. Studies such as Souza et al.[9] lead us to conclude that violence is a factor in mortality of young people, and in Brazil these issues are enhanced by intense inequalities and other adverse citizenship conditions.

Cost of hospitalization

The cost of hospital stay demonstrates initial economic impact of TSCI. Studies estimate that patients who come to hospital emergency unit with this trauma have a significant degree of complexity, with risk of death and need for complex care[8,15,20,24]. Thus, it can be thought that hospitalization time depends on the survival time and the complexity of patient's injuries. This set of factors, then, makes higher the cost of hospitalization.

Because of high standard deviation in cost (R$4.868,90), the median (R$907,62) better represent the sample. However, when comparing mean (R$ 2.943,57) with other studies[18,22,27], the costs of this study are presented above. Highest percentage of patients with neurological impairment and longer hospitalization stay in our sample justify this higher mean cost.

It is noteworthy that in Brazil, resources for the health sector are scarce and repayment of amounts charged by the Public Health System (PHS) only cover part of costs of hospital services. Studies such as Soares e Santos[29], show that reimbursement amounts have proven lagged behind the actual costs of services.

It is also necessary to consider that, when the TSCI results in disruption of spinal cord, it is required multidisciplinary monitoring for life with recurrent hospitalizations and sequential high costs are identified with this injury[25].

Study limitations

This study has some limitations and difficulties as: (1) difficult location of cases of TSCI through manual search of records; (2) records shortages and / or incomplete data and (3) lack the standardization of records.

Also, it is necessary to mention that the use of secondary data prevents performing more elaborate multivariate analysis. In addition, information quality may vary according to type of management, regarding accuracy of information from medical records. However, considering the ecological effect of information, the analysis is appropriate to the type of inference that this research proposed.

CONCLUSION

Epidemiological data showed more often TSCI in adults, males, with low education level and occupation of providing services and trade. Most patients were from the capital of Goiás state or its metropolitan area. Patients from interior were especially of southern region.

Traffic accident proved to be the main cause, with emphasis on motorcycle accidents. IBF was an important cause, more often in male. Falls also presented relevance.

Thoracolumbar were the most affected vertebras, and most patients showed no spinal injury, but more than half of them had some motor deficit. Treatment of choice for majority of cases was conservative and most cases did not require ICU. Associated injuries were common. TBI was the most frequent one.

Hospital stay mean was 6 days, being higher in surgical patients (15 days). Total cost of admissions proved to be underestimated.

Mortality was 14% and risk factors were age less than 60 years old, cervical spine trauma, complete spinal cord disruption and physical assault as etiology.

This research does not only allow characterization of TSCI in central region of Brazil as well as contribute to managers's action planning of health in order to drive targeted strategies for promotion and prevention health.

Moreover, relevance of studies of this nature becomes evident when we note that the only way to improve the quality of life of the population and reduce costs of these patients is to prevent complications from happening.

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