

## Traumatic injury to the spinal cord. Prevalence in Brazilian hospitals

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Traumatic spinal cord lesions have a worldwide high morbidity and mortality, and in many developed countries the problem has received special attention, based on epidemiological studies. In Brazil these studies have been restricted to institutional data. In 1988 a survey conducted by the Integrated System of Traumatology and Orthopaedics, covering 36 public hospitals from 7 Brazilian capitals, revealed a point prevalence of 8.6% (108 patients) with spinal cord injury, aged from 6–56 years; 81% were men. The most frequent causes were traffic accidents (42%), firearms (27%) and falling from heights (15%). The main complications were pressure ulcers (54%) and urinary infections (32%).

*Key words:* spinal cord injuries; epidemiology, traffic accidents; hospitalization; Brazil.

### Introduction

Spinal cord lesions can lead to high rates of morbidity and mortality. The severity and prognosis depends on different factors, such as the aetiology and the degree and level of the lesion.

There is an increasing number of traumatic causes,<sup>1,2</sup> and recognition of the causes can lead to prevention and control programs. Epidemiological studies in the USA reveal an incidence of 30/40 cases per million of the population each year, with a prevalence of 72–250,000 cases.<sup>3–6</sup> Typical patients are male, aged 15–34 years, victims of a traffic accidents, paraplegic, with complications such as urinary infection, pressure ulcers and with an expectation of life of 30 years following the injury.

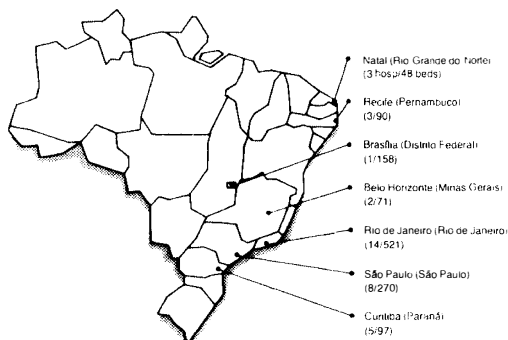
In Brazil, apart from isolated institutional studies and data<sup>7,8</sup> there are no large scale and systematic studies, but this study is an initial step in defining the problem of spinal cord injury (SCI), by studying the prevalence in orthopaedic and traumatology wards in 36 hospitals.

### Methods and patients

This study was conducted from information obtained from a survey carried out by the Integrated System of Traumatology and Orthopaedics (Sistema Integrado de Trau-

matologia e Ortopedia – SIRTO), a group created by the Brazilian Government, with the objective of evaluating medical assistance in the areas of traumatology and orthopaedics in the country.

The technical committee of SIRTO conducted a study of point prevalence to evaluate the population of patients hospitalized in orthopaedic and traumatology wards in 36 public hospitals (1,255 beds) of 7 capitals of Brazilian states, the Federal District, Rio de Janeiro, São Paulo, Minas Gerais, Parana, Rio Grande do Norte and Pernambuco (Fig 1). Considering these capitals, this study involved 23% (36/155) of



**Figure 1** Distribution of the number of hospitals and total number of beds in the capitals (state) in Brazil.

public hospitals; it represents 6.2% (36/582) of all hospitals (private and public) and 9.2% (1,255/13,602) of the total hospital bed capacity.<sup>9</sup>

Information was obtained from data collected by nurses on a predetermined day (between March and September 1988) of the visit of hospitalized patients and/or consultation of hospital charts. Age, sex, socioeconomic indicators, demographic characteristics and information regarding principal and secondary diagnoses, aetiology, treatment, previous and present complications were all registered. Nurses from each state involved in the study were trained at the Hospital for Medicine of the Locomotor System (HMLS)/SARAH in Brasilia, where the data was gathered, criticized, codified (9th Revision of International Classification of Disease) and recorded in a microcomputer.

All patients with diagnostic codes 806 (vertebral fracture with spinal cord injury) and 952 (spinal cord injury without evidence of vertebral fracture) were included in the study and principal epidemiological characteristics were correlated and analyzed. In order to obtain a broader view of the different pathologies that affect the spine we also collected data from diagnostic codes 344.0 (quadriplegia), 344.1 (paraplegia), 805 (vertebral fracture without spinal cord injury) and 839 (vertebral luxations and others).

The results were analyzed using the software EPI INFO (version 3). Chi-square and Fisher exact test were used when indicated, using 5% as the limit for significance.

## Results

There was a total of 1,255 hospitalized patients (traumatic/orthopaedic) of which 158 (12.6%) presented vertebral and/or spinal cord lesions of different causes. The majority of these (108 patients) presented a traumatic spinal cord lesion, resulting in a prevalence of 8.6% (108/1255). The remainder of the patients 30 (19%) presented vertebral lesions, without a neurological deficit, and 20 (12.7%) had a spinal cord lesion and/or vertebral lesion from other causes (45% from tumors, 15% from tuberculosis), as specified in Table 1.

In 108 patients with SCI, 87 cases (80.6%) were males with a ratio female:male 1:3.9. The average age was  $30.3 \pm 1.1$  years (mean  $\pm$  SEM), varying from 6–56 years, with the majority of patients (75.9%) found between 11 to 40 years. When the distribution of age groups was analyzed in relation to sex, we observed a significantly higher frequency of SCI in males between 11–50 years (Fisher exact test,  $p = 0.013$ ). The median time since injury was  $605.1 \pm 117.8$  days, range 2 to 6,957, on the day of the study. The median time of hospitalization was  $126.7 \pm 18.1$  days (1–1,657). Only 11 patients had been injured for less than 30 days. Traffic accidents were responsible for 41.7% of the cases (45 patients), followed by firearms (29, 26.9%), falls from heights (16, 14.8%), shallow diving (10, 9.3%) and knife wounds (1, 0.9%). More traffic accidents occurred on a Saturday than on any other day ( $\chi^2 = 5.99$ ,  $p = 0.014$ ). At least 23 cases (21.3%) were considered as work

**Table I** Distribution, point prevalence and aetiology in patients with spinal cord and/or vertebral lesion, in Brazilian hospitals, 1988

	Patients (%)	% In relation to the total of hospitalized patients (1255)
Traumatic spinal cord lesion	108 (68.0)	8.6
Vertebral lesion without neurological deficit	30 (19.0)	2.4
Non traumatic spinal cord and/or vertebral lesion	20 (12.7)	1.6
Total	158 (100.0)	12.6

Source: SIRTO, 1988.

accidents; in 17 (15.7%) this information was not defined. We did not observe a significant relation between type of trauma and sex (Fisher exact test,  $p > 0.05$ ). Only 6 patients (5.6%) with SCI had a high educational level. Ninety-four (87.0%) of the patients had complete spinal cord lesions; 61 (64.9%) were paraplegic and 33 (35.1%) quadriplegic, with the ratio quadriplegia: paraplegia of 1:1.8. We observed a significant relationship between cervical lesions and diving (Fisher exact test,  $p < 0.05$ ), and also between thoraco-lumbar lesion and firearms ( $\times 2 = 7.2$ ,  $p < 0.05$ ).

Analyzing associated lesions with SCI, 32 patients (29.6%) presented with 60 other injuries: trunk (33.3%), head injuries (25%), fracture/wounds of the lower limbs (26.7%) and upper limbs (15%). There was no significant relationship between associated injury and level of spinal lesion ( $\times 2 = 3.28$ ,  $p > 0.05$ ).

A total of 85 patients (78.7%) presented at least one clinical complication (Table II). Pressure ulcers were the most frequent complication – 73 cases (54.1%), followed

**Table II** Frequency of the complications presented by 78.7% of the patients with traumatic spinal cord lesion, hospitalized in Brazilian hospitals, 1988

Complication	Frequency (%)
Pressure ulcers	73 (54.1)
sacral	19
trochanter	5
gluteus	4
heel	1
not defined	44
Urinary	44 (32.6)
infections	43
others	1
Osteomyelitis	5 (3.7)
Pulmonary (infections)	4 (3.0)
Abdominal (infections)	4 (3.0)
Others*	5 (3.7)
Total	135 (100.0)

Source: SIRTO, 1988.

\*there were recorded 2 cases of respiratory failure, 1 sepsis, 1 deep vein thrombosis and 1 bacterial endocarditis.

by urinary complications, mainly infections, in 43 cases (31.9%). The commonest site of pressure ulcer was the sacral region (19, 26.0%), followed by the trochanter (5, 6.8%); in 44 cases (60.3%) the site of the ulcer was not defined.

Concerning the distribution of patients, in the 36 hospitals only 12 (33%) contained patients with traumatic spinal cord lesions. The majority of these patients were treated at the Hospital for Medicine of the Locomotor System/SARAH (71 patients, 65.7%). Since this hospital is dedicated to rehabilitation, by its exclusion the point prevalence decreased to 3.4% (37/1097).

The East and Central East regions had the highest occurrence of trauma causing SCI, 38.9% and 21.3% respectively. São Paulo was the state with the largest number of accidents (22, 20.4%).

## Discussion

Epidemiological studies referring to SCI are justified not only because of the magnitude of morbidity, mortality and the associated hospital cost of patients with these lesions, but above all because of the potential of prevention. Also we can obtain an up to date estimate of the number of hospital beds available for the treatment of these patients. The definition of risk groups and aetiological factors will determine the strategies for the more rational prevention programs. These studies involve a very large number of methodologies and data, from national and from regional sources involving many institutions.

In the USA, it is estimated that the incidence of spinal cord injury varies between 28–50 patients/million persons/year, with a prevalence of about 250,000 cases.<sup>3,5,6</sup> The cost of medical and social assistance for North America exceeds 7.4 billion dollars a year.<sup>10</sup> In other developed countries we find incidences of 12.7 in France,<sup>4</sup> 14.7 in Canada,<sup>11</sup> 16.5 in Norway<sup>12</sup> and 35.7 persons/million/year in Germany,<sup>2</sup> depending on the applied methodology.

In Latin America no specific study has been attempted to define this problem other than isolated institutional data.<sup>13</sup> In Brazil, Sposito *et al*<sup>7</sup> and Masine *et al*<sup>8</sup> also

performed an institutional analysis. In a brief revision of the term 'spinal cord injury', using the medical journal publications index from Latin American and Caribbean data base (LILACS), from the year 1982 to 1991, we found only 55 published papers on this topic (literature search performed in July, 1991). The conclusion of this revision was that there was no publication specifically directed to studying the prevalence and the incidence.

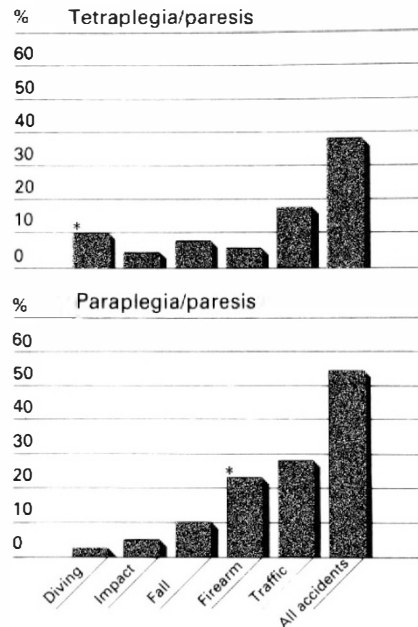
The present study is an initial step in this direction, being the first study to assess the prevalence of SCI in several Brazilian hospitals. Other factors should be considered in this type of study; for example the patients who died at the site of injury or on admission to hospital, since around 80% of deaths normally occur in the prehospital phase.<sup>3</sup> Caution should also be taken in interpreting figures from a study representing only a small proportion of the total hospital beds in the capitals (9.2%).

The point prevalence of 8.6% of this study is high, emphasizing the importance of traumatic SCI in Brazil. Even without the HMLS/SARAH beds, the prevalence of 3.4% is relevant. This fact is important when we consider the seriousness of the condition, the majority of patients requiring a long period of hospitalization, involving high economic and social costs. Most patients were young (11–40 years) male paraplegics, with a lower educational level; the principal cause of injury was traffic accidents, particularly occurring on a Saturday. The next most frequent cause was gunshot wounds. The fact that the majority of cases were found in the most developed and prosperous region (East and Central East, including São Paulo state) of the country reflect the violence existing in our society with a high traffic density in large cities. These results may reflect the city violence typical of countries presenting a disorganised increasing rate of industrialization, facing land problems, immigration to the cities and a deterioration of social aspects. The high rates for work related injuries (at least 21%) seem to reinforce this impression. This study confirms that some accidents are related to a particular level of lesion, for example high lesions related to

diving accidents and paraplegia due to gunshot wounds<sup>14–16</sup> (Fig 2).

The complications observed in our study (Table II) repeat the same situation related in studies in other countries<sup>17,18</sup> and emphasizes the need for the development of new technologies and approaches for the care and rehabilitation of these patients. In this context the value of spinal units with specially trained personnel is obvious. Thirty percent of the patients had other injuries, most frequently involving the head, chest and lower limbs. Similar findings have been reported.<sup>19</sup>

Brazil is a country of 8,511,965 Km<sup>2</sup> with a population of 140 millions, where trauma is the third cause of death but the first one among people aged between 11–40 years old.<sup>9</sup> To face up to this grave problem the country is from 1990 implementing a new plan of care for traumatic victims in its 27 capitals where the initial care, and pre-hospital assistance, is given by the fire brigade who have received special training.



**Figure 2** Percentual distribution of aetiology by level and degree of lesion in 106 spinal cord injury patients. In 2 cases this information was not available.

\**p* < 0.05, between levels.

In order to increase the number of beds for this type of injury, the Brazilian government is establishing a network of hospitals exclusively dedicated to rehabilitation, including SCI patients, which is under the coordination of the HMLS/SARAH. This network will be fully operational in 5 years.

Thus, the present study defines nationwide the main risk group for SCI, in order to address prevention campaigns. In relation to traffic accidents, mandatory seat belt laws were only recently introduced in Brazil, with an increasing awareness of this question by governmental authorities and the general population. We suggest that the following points should be considered and implemented in the elaboration of prevention programs: traffic campaigns – educa-

tion and strict legislation – encouraging the maintenance of cars, the mandatory use of seat belts, conservation of the highways and police control. As far as diving accidents are concerned, monitoring the levels of water during the dry season and alerting the population with posters showing the risks of diving in shallow water should all help. The solution also depends on a more acceptable distribution of income and, consequently, an improvement in the quality of life and education.

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