



# Epidemiological Study of Patients with Spinal Cord Injury Treated in POLEM, a Specialized Clinic in São Paulo State – Brazil

## *Estudo epidemiológico de pacientes com lesão medular tratados na POLEM, clínica especializada no estado de São Paulo – Brasil*

José Eduardo de Andrade Lopes<sup>1</sup> Karl Alex Patteis dos Santos<sup>1</sup> Caroline da Costa Machado<sup>1</sup>  
 Meire Cristina Borges<sup>1</sup> Eder Ferreira Coelho<sup>1</sup> Íris Lino Kemp Simões<sup>1</sup> Ivone Mara Pereira<sup>1</sup>  
 Mariele Torricelli Brunelli Dalera<sup>1</sup> Talita Schneider de Camargo Bertazini<sup>1</sup>  
 José Eduardo de Andrade Lopes<sup>1</sup>

<sup>1</sup> POLEM – Associação de Apoio às Pessoas com Lesão Medular, São Paulo, SP, Brazil

Address for correspondence José Eduardo de Andrade Lopes, Rua Domingos Sínico, 334, Jardim Guaçu-Mirim, Mogi Guaçu, SP, 138433320, Brazil (e-mail: joseitalopes2@gmail.com).

Arq Bras Neurocir

### Abstract

**Objective** To analyze the epidemiological profile of patients with spinal cord injury treated at POLEM – Associação de Apoio às Pessoas com Lesão Medular (Association for Supporting People with Spinal Cord Injury).

**Method** The population studied comprised 113 patients with spinal cord injury, of traumatic or nontraumatic etiology, and the data obtained were compared with those of other institutions.

**Results** Of the 113 patients, 70.8% were male and 29.2% female. Traumatic lesions were responsible for 54% of the patients, and nontraumatic for 46%. Of the patients with traumatic injury, 90.2% were male, the main cause being traffic accidents. In nontraumatic lesions, women were the most affected, 51.9%; and dysraphism and myelitis were the main causes (31% and 21%, respectively).

**Conclusion** The results showed an important incidence of spinal cord injury due to trauma, mainly affecting young individuals of productive age and low educational level, representing high economic and social costs. The data found in the present study are similar to those of other studies performed in our country.

**Objetivos** Analisar o perfil epidemiológico dos pacientes com lesão medular atendidos na POLEM – Associação de Apoio às Pessoas com Lesão Medular.

**Método** A população estudada compreendeu 113 pacientes com lesão medular, de etiologia traumática ou não, e os dados obtidos foram comparados com os de outras instituições.

### Keywords

- ▶ spinal cord injury
- ▶ epidemiology
- ▶ causes
- ▶ rehabilitation

### Resumo

received  
March 19, 2020  
accepted  
September 4, 2020

DOI <https://doi.org/10.1055/s-0040-1719009>.  
ISSN 0103-5355.

© 2021. Sociedade Brasileira de Neurocirurgia. All rights reserved.  
This is an open access article published by Thieme under the terms of the Creative Commons Attribution-NonDerivative-NonCommercial-License, permitting copying and reproduction so long as the original work is given appropriate credit. Contents may not be used for commercial purposes, or adapted, remixed, transformed or built upon. (<https://creativecommons.org/licenses/by-nc-nd/4.0/>)  
Thieme Revinter Publicações Ltda., Rua do Matoso 170, Rio de Janeiro, RJ, CEP 20270-135, Brazil

**Palavras-chave**

- ▶ lesão medular
- ▶ epidemiologia
- ▶ causas
- ▶ reabilitação

**Resultados** Dos 113 pacientes, 70,8% eram do sexo masculino e 29,2% do sexo feminino. As lesões traumáticas foram responsáveis por 54% dos pacientes, e as não traumáticas por 46%. Dos pacientes com lesão traumática, 90,2% eram do sexo masculino, sendo a principal causa os acidentes de trânsito. Nas lesões não traumáticas, as mulheres foram as mais acometidas, 51,9%; e o disrafismo e as mielites foram as principais causas (31% e 21%, respectivamente).

**Conclusão** Pelos dados obtidos, mostrou-se a incidência importante de lesão medular por trauma, acometendo principalmente indivíduos jovens, em idade produtiva e com baixo nível de escolaridade, representando elevados custos econômico e social. Os dados encontrados no presente estudo são semelhantes a outros realizados em nosso país.

**Introduction**

Spinal cord injury (SCI) is one of the most devastating lesions that can compromise people's health. Besides physical incapacity, it causes serious psychological, financial and social losses.

As an aggravating factor, care with people with spinal cord injury, in addition to treatment in the acute phase, requires continuous multidisciplinary care, without which the patient will not be better recovered. All this entails enormous expenses. In Canada, according to Krueger et al., the lifetime treatment cost of a person with incomplete paraplegia is around CAD \$ 1.47 million, while for a person with complete quadriplegia the cost is around CAD \$ 3.03 million. This estimate includes the costs of the various complications that occur. The annual expense for treating people with spinal cord injury in Canada reaches CAD \$ 2.67 billion.<sup>1</sup> Most studies show a high male/female ratio, especially in traumatic lesions, with a high incidence in young individuals, ~ 30 years old. Traffic accidents are the main etiological agent.<sup>1</sup>

We try to show the causes of spinal cord injury and its level, stratified according to gender, age when the injury occurred, time elapsed between the onset of illness and the start of treatment, socioeconomic situation, nutritional status of the patients, function of the bladder and bowel.

Studies on the epidemiology of spinal cord injury in Brazil and even in South America are rare.<sup>2,3</sup> Data on the prevalence and treatment costs are also uncertain. With the present study, we try to show the main causes and nuances of this disease in our association and make a comparison with other works performed both in Brazil and in other countries.

It is intended mainly, together with other published works, to provide subsidies for the establishment of strategies for prevention and treatment, reducing the suffering of people and expenses arising from this serious illness.

**Methods**

The records of 113 patients suitable for the start of rehabilitation activities at POLEM were analyzed and reviewed. All of the patients had a clinical diagnosis of spinal cord injury. The data that will be included in the present study were obtained from clinical records, both from active patients still in the

process of rehabilitation, and from patients who no longer participate in the activities in the association.

The charts analyzed include the initial evaluations of the therapeutic segments, and the anamneses of the physiotherapy, neurology, occupational therapy, nutrition, psychology (patient and caregiver), nursing, and social services sectors were reviewed.

The variables analyzed in the present study were: gender, types of injury (traumatic or nontraumatic), etiology and level of injury, age when injured, age at the start of rehabilitation, time interval between the onset of lesions and early rehabilitation, schooling, marital status, whether or not they have any type of health plan, use of assistive technology, receipt of benefits, caregivers, body mass index (BMI), bowel functioning and bladder catheterization.

The collected data was typed in spreadsheets of the Microsoft Excel application in Windows 7 (Microsoft Corporation, Redmond, WA, USA), in the form of double entry for the verification of typos. The descriptive analysis was performed and presented in absolute and relative frequency distribution tables (percentage).

**Results**

Out of the total number of 113 assisted patients, 80 (70.8%) were male and 33 (29.2%) were female, a ratio of 2.42:1. Of these, 61 (54%) suffered traumatic injuries and 52 (46%) had nontraumatic lesions, with a ratio of 1.17:1.

Among the traumatic lesions, 55 (90.2%) of the patients were male and 6 (9.8%) were female, the ratio was 9.16:1.

In the nontraumatic lesions, unlike the traumatic lesions, the predominance was female, 27 (51.9%), while in males there were 25 (48, 1%), ratio 1.08:1.

Among the traumatic injuries, traffic accident stood out with 33 patients, 15 by car accident, 13 by motorcycle accident, and 5 by trampling. In traffic accidents, 7 patients had between 11 and 20 years old, 4 male and 3 female. In the age group of 21 to 40 years old, there were 30 men and no women. Between 41 and 60 years old, there were 3 male patients and no female patients. Among the traumatic injuries, the injuries due to fall of height, injury by firearm projectile, diving in shallow water and trauma by load should be highlighted. See ▶ **Table 1**.

**Table 1** Traumatic Etiology

Traumatic Etiology	Absolute number	%
Automobile accident	15	25
Motorcycle accident	13	21
Fall of height	11	18
Firearm Injury (FAI)	8	13
Trampling by car	5	8
Trauma by load	6	10
Shallow water diving	3	5
Total	61	100

**Table 2** Nontraumatic Etiology

Nontraumatic Etiology	Absolute number	%
Spinal cord Disraphism	16	31
Myelitis	11	21
Tumoral	10	19
Cervical spondylosis myelopathy	4	8
Vascular disease	3	6
Amyotrophic lateral sclerosis	2	4
Multiple sclerosis	2	4
Syringomyelia	2	4
Could not report	2	4
Total	52	100

Among nontraumatic lesions, dysraphism is the main cause, followed by myelitis. See ► **Table 2**.

Regarding the level of the lesion, the thoracic region was the most affected, followed by the cervical region and finally the lumbar region. See ► **Table 3**

The mean age for incidence of the lesion (traumatic or nontraumatic) was 38 years and 3 months old, ranging from 1 day old (congenital lesion) to 75 years old. The time interval between the incidence of the lesion and the beginning of rehabilitation in the association was 6 years and 5 months, ranging from 1 month old to 43 years and 3 months old.

Regarding marital status, 47 individuals (4 1.6%) were married and 45 (39.8%) were single. Widows accounted for 6 (5.3%), divorced for 7, (6, 2%) and 8 (7.0%) lived in a stable union.

Of those assisted, 42 (37.2%) had health care plans and 61 (53.9%) were users of the Brazilian Unified Health System (SUS, in the Portuguese acronym). In 10 charts we did not find such information.

Among the beneficiaries, 107 (94.7%) used one or more types of assistive technology, and the most common were: wheelchair, shower chair, long tutors with pelvic belt, special mattress and others. See ► **Table 5**.

Out of the patients treated, 40 (35.3%) were in retirement, 27 (23.9%) were sick, and 13 (11.5%) were under Continuous

**Table 3** Injury Level

Injury Level	Absolute number	%
Thoracic	57	50
Cervical	37	33
Low back	19	17
Total	113	100

**Table 4** Level of schooling

Level of schooling	Absolute number	%
Did not complete elementary school	54	47.7
Completed high school	28	24.7
Completed higher education	7	6.2
Did not complete high school	6	5.3
Completed elementary school	5	4.4
Attended nursery school	3	2.7
Illiterate	3	2.7
Attended technical education	2	1.8
Not old enough to attend school	2	1.8
Did not complete higher education	1	0.9
Attended special education	1	0.9
No information found	1	0.9
Total	113	100

**Table 5** Type of assistive technology

Type of technology	Absolute number	%
Wheelchair	90	80
Shower chair	52	46
Tutor long with pelvic belt	9	8
Gutters	21	19
Walker	13	11
Egg Box Mattress	14	12
Others *	46	41

\* others: long tutor without pelvic belt (1 patient), board transfer,<sup>2</sup> bracing for shaving,<sup>1</sup> bracing for the computer,<sup>1</sup> hand orthosis,<sup>4</sup> splint to handle<sup>4</sup> abdominal strap,<sup>1</sup> compression stocking,<sup>4</sup> positioning roller,<sup>1</sup> cervical collar,<sup>1</sup> Putti vest,<sup>1</sup> Canadian crutches<sup>5</sup> axillary crutches,<sup>1</sup> common cane,<sup>2</sup> 4-point cane,<sup>2</sup> water mattress,<sup>2</sup> air mattress,<sup>3</sup> hospital bed,<sup>7</sup> water seat,<sup>4</sup> air seat,<sup>3</sup> gel seat,<sup>1</sup> vehicular adaptation.<sup>1</sup>

Benefit Payment (BPC, in the Portuguese acronym). In 33 records, there was no reference to the receipt of benefits.

In the charts analyzed, 98 patients (86.7%) received caregiver assistance and 10 (8.8%) did not receive it, and in 5 (4.4%) medical records no information was found in this regard.

Bladder emptying data show that 20 patients (17.7%) had urinary incontinence, 48 (42.5%) had intermittent clear

catheterization, 38 (33.6%) had spontaneous urination, 2 (1.8%) underwent cystostomy, and in 5 medical records (4.4%) we did not obtain data.

Regarding nutritional status, of the 113 patients evaluated, 30 (26.5%) were eutrophic, 21 (18.6%) were preobese or overweight. The same number of 5 patients (4.4%) for grade III and grade I low weight was found. There were 3 patients with grade II low weight (2.7%).

The variables for classification of BMI were: grade I obesity, 7 patients (6.2%), grade II, 2 patients (1.8%), grade III, 1 patient (0.9%). In 39 (34.5%) of the patients, the BMI was not evaluated.

Regarding intestinal function, it was found that 30 (26.5%) had constipation and that 60 (53.1%) didn't, and 23 patients (20.4%) were not evaluated.

## Discussion

In the present study, the data show a significant prevalence of spinal cord injury in men, which is in agreement with data found globally.<sup>2</sup> This number is due to the high incidence of trauma as a cause in males. Of note among the traumatic causes are traffic accidents as the main responsible for SCI, and the main site of injury is the thoracic spine, followed by the cervical spine.

In the literature found in national journals, however, there is divergence in the data, some differing mainly in the cause and location of the trauma.

An epidemiological study performed at the Lar Escola São Francisco, in the city of São Paulo, state of São Paulo, Brazil, with 171 patients seen from 1999 to 2001, showed that 107 (62.6%) were male and 64 (37.4%) were female. The mean age of those attended was 35.4 years old, ranging from 1 to 78 years old. These data are similar to those found in the present study. There was a discrepancy in the causes, because in 53 (30.1%) it was due to firearm injury (FAI), 30 (17.5%) due to falls, 23 (13.4%) due to tumor, and 15 (8.8%) due to traffic accident.<sup>3</sup>

Work done by Botelho et al. at the Hospital Mandaqui in São Paulo, where 95 patients with medullar spinal trauma were attended, 82 (86.3%) were male and 13 (13.7%) were female, a ratio of 6.3:1, numbers close to those shown in the present study. Regarding the etiology, the main ones were: falls, 31 patients (32.6%), automotive accident ( $n = 22$ ; 23%), dive in shallow water ( $n = 14$ ; 14.7%), and FAI (5.2%).<sup>4</sup> These data are different from those found in POLEM.

In the Physiotherapy Outpatient Clinic of the Universidade de Ciências Médicas da Paraíba, a survey of 59 patients showed that 55 (93.22%) were male and 6 (6.77%) were female. The mean age was 34 years old and the thoracic segment was the most affected ( $n = 30$ ; 50.84%), followed by the cervical segment ( $n = 24$ ; 40.67%) and by the lumbar segment ( $n = 5$ ; 8.47%). Among the causes, FAI was the main one, with 27 patients (45.76%), followed by car accident, with 12 (20.33%) patients.<sup>5</sup> In the Disability Service Center (DAC, in the Portuguese acronym) of the Universidade de Passo Fundo, out of the 49 patients attended, 40 (81.6%) were male and 9 (18.4%) were female. The thoracic level was the most

affected (77.5%), and the main causes were falls (36.7%), traffic accidents (32.7%) and FAIs (24.5%).<sup>6</sup>

In the masters dissertation of Noronha, in June 2008, she evaluated 156 patients with spinal cord injury. The main causes were 37 patients (23.7%), 32 due to FAI (20.5%), and 31 due to car accident (19.9%). There was a predominance of lesions in the thoracic level (45.8%), followed by the cervical level (43.2%).<sup>7</sup>

Another study, performed by Brito et al., comprised 87 patients, 71 (81.6%) male and 16 (18.4%) female, with a mean age of 33.9 years old. The most affected level was the thoracic, with 33 patients (37.9%), followed by the cervical, with 23 patients (26.4%), numbers close to those shown in the present study. Regarding the etiology, falls occurred in 37 patients (42.6%), followed by car accident in 21 (24.2%), motorcycle accident in 15 (17.2%) and FAI in 11 (12.6%).<sup>8</sup>

A study performed at the Neurological Physiotherapy Outpatient Clinic of the Hospital Universitário Regional do Norte do Paraná, with 25 patients with complete SCI, showed that 20 (80%) were male and 5 (20%) were female, with a mean age of 34, 6 years old. Regarding the etiology, 50% were victims of car accident, 20.8% were victims of FAI, 12.5% were whitewash and 8.3% were due to surgical procedures.

Custódio et al., in a retrospective survey with a sample of 208 patients, showed that 164 (78.85%) were male and 44 (25.15%) were female. Traffic accidents corresponded to 44.70% of the cases, motorcycle accidents to 56 patients (26.92%), automobile accident to 37 patients (17.78%), FAI to 30 patients (14.42%), fall to 13.94%, tumor to 7.69%, diving in shallow water to 5.76%, myelopathy due to stenosis to 2.88% and myelitis to 3.36%. The most affected level was the thoracic (54.8%), followed by the cervical (35.1%) and the lumbar (10.1%).<sup>10</sup>

In underdeveloped or developing countries, the percentage of SCI due to traumatic causes, mainly due to traffic accidents, is considerably high. In developed countries, this index has fallen, and the number of people with nontraumatic SCI has increased. But, even in these countries, there are disparate numbers. In Ontario, Canada, the main cause of traumatic SCI is fall from height. And in the states of Alabama and Mississippi, USA, the injury by violence is the main cause. Sports and recreational injury is the leading cause in the British Columbia, Canada (17.9%), in Utah (15.7%), USA, being the lowest in Mississippi (3.5%).

Among the nontraumatic causes, there is also a great variation in the data found. In the present study, dysraphism and myelitis are the main causes, being that dysraphism showed a superior number to the ones found in the international studies.

It was also observed in the present study that the mean age for the incidence of the lesion was 35 years and 3 months old, and the time interval between the beginning of the SCI and the start of the rehabilitation center suitable 6 years 5 months, which is compatible with data found in other studies conducted in Brazil.<sup>3,7,10</sup>

Another important fact is the low level of schooling among the patients, coinciding with data from the Brazilian

Institute of Geography and Statistics (IBGE, in the Portuguese acronym) Demographic Census, conducted in 2010, which indicates that there are 45.6 million Brazilians with at least 1 type of disability. Out of this total, 6.7% have complete higher education and 61% have no education or incomplete fundamental level.

Among nontraumatic causes, there is also great variation in statistics. In a study conducted in Okayama, Japan, the incidence of nontraumatic spinal cord injury is 20 per 1 million people and degenerative spinal disease accounts for 59% of the cases. Tumors account for 19% of the cases.<sup>2</sup>

In South Asia, only India has epidemiological data in three studies on the causes of SCI. High rates of bone-marrow tuberculosis were found in Bangalore (26%), Karnataka (25%) and Kashmir (38%). But tumors also have a high incidence, 29% in Bangalore and 27% in Karnataka.<sup>2</sup>

In Western Europe, data from 8 countries are reported: Denmark, France, Germany, Israel, Italy, The Netherlands, Scotland and Spain. The median incidence of nontraumatic spinal cord injury was 6 per 1 million people per year. We found high tumor rates (25%) and degenerative spine disease (32%) on average. Dysraphism was found in 5% in Spain and Italy and in 2% in Denmark. Myelitis was the cause in 7% of the cases in Israel, 14% in Denmark, and 23% in Italy.<sup>2</sup>

In Turkey, studies in Ankara showed that tumors (29%) and degenerative diseases of the spine (29%) were the main causes. In Istanbul, tumors and degenerative diseases of the spine were responsible for 22% and 25%, respectively. Inflammatory diseases were responsible for 23% of the cases in Ankara and of 20% in Istanbul. Dysraphism was the cause in 6% of the cases.

In the USA, a retrospective 5-year study points to spinal stenosis and tumors as the main causes of SCI, with 54% and 26%, respectively. Myelitis accounted for 5% of patients treated.<sup>11</sup> See **table 4**.

## Conclusion

It was demonstrated in the present study that trauma represents the main cause of SCI affecting patients treated by POLEM, with the thoracic spine being the most affected. Out of the population studied, the highest incidence occurs in the young population, in working age, with a large majority of families with low educational level, representing a high economic and social cost. Based on the present study and on several others, preventive measures should be traced to decrease the incidence of this disease, which is a real tragedy.

## Authors' Contributions

To perform this work, all authors contributed to the data collection and their individualization in the area of action, literature, discussion, review, approval and drafting the final version of the results. Lopes J. E. A.: article intellectual concept and study design; Simões I. L. K.: confection of graphics and tables, typing.

## Conflict of Interests

The authors have no conflict of interests to declare.

## References

- 1 Singh A, Tetreault L, Kalsi-Ryan S, Nouri A, Fehlings MG. Global prevalence and incidence of traumatic spinal cord injury. *Clin Epidemiol* 2014;6:309–331
- 2 Lee BB, Cripps RA, Fitzharris M, Wing PC. The global map for traumatic spinal cord injury epidemiology: update 2011, global incidence rate. *Spinal Cord* 2014;52(02):110–116
- 3 Ingham SJM, Gaspar AP, Vianna PPC, Santos FPE, Masiero D, Puertas EB. Avaliação Epidemiológica dos pacientes com lesão medular atendidos no Lar Escola São Francisco. *Coluna/Columna* 2004;3(01):26–29
- 4 Botelho RV, Abgussen CMB, Machado GCFPM, et al. Epidemiologia do trauma raquimedular cervical na zona norte da Cidade de São Paulo. *Arq Bras Neurocir* 2001;20(3–4):64–76
- 5 Salomão AF, Soares PN, Lucareli PRG, Freitas SKT, Lima FPSL, Lima MO. Estudo epidemiológico dos pacientes com traumatismo raque-medular atendidos na Clínica de Fisioterapia da UNIVAP. X Latin American Meeting of Scientific Initiation and VI Latin American Meeting of Graduate Studies - University of Vale do Paraíba - 07/07/2015. Accessed in May / 2018. 757–760. Available at <https://www.researchgate.net/publication/266890513>.
- 6 Bühker MA, Lucatelli V, Amaral RB, Rockenbach CWF. Perfil clínicoweb e epidemiológico dos pacientes com lesão medular atendidos no Centro de Atendimento à Deficiência (CAD). XVI Scientific Initiation and IX Extension Exhibition. University of Passo Fundo - RS. 04,05,06 / October / 2011. Accessed in May / 2018. Available at [www.unicruz.edu.br/seminário/anais/anais-2011/saude](http://www.unicruz.edu.br/seminário/anais/anais-2011/saude).
- 7 Noronha JB. Levantamento epidemiológico dos casos de lesão medular espinhal traumática atendidos em unidade de reabilitação de Goiânia – Goiás [thesis]. Goiânia: Catholic University of Goiás; 2008
- 8 Brito LMO, Chein MBC, Marinho SC, Duarte TB. Epidemiological evaluation of victims of spinal cord injury. *Rev Col Bras Cir* 2011; 38(05):304–309
- 9 Citadini JN, Scholtão J. Souza Roger Burgo, Garanhani MR Perfil epidemiológico dos pacientes com lesão medular do Ambulatório de Fisioterapia Neurológica do Hospital Universitário Regional do Norte do Paraná Jan. 2203. Accessed in May / 2018. Available at: <https://www.researchgate.net/publication/238713586>
- 10 Custódio NRO, Carneiro MR, Feres CC, et al. Lesão medular no Centro de Reabilitação e Readaptação Dr. Henrique Santillo (CRER-GO). *Collun* 2009;8(03):265–268
- 11 New PW, Cripps RA, Bonne L. Global maps of non-traumatic spinal cord injury epidemiology: towards a living data repository. *Spinal Cord* 2014;52:97–109