

# EPIDEMIOLOGY OF VERTEBRAL SPINE FRACTURES IN A HOSPITAL IN SÃO PAULO IN THE TWO-YEAR PERIOD 2017-2018

EPIDEMIOLOGIA DAS FRATURAS DA COLUNA VERTEBRAL EM HOSPITAL DE SÃO PAULO NO BIÊNIO 2017-2018

EPIDEMIOLOGÍA DE LAS FRACTURAS DE LA COLUMNA VERTEBRAL EN UN HOSPITAL DE SÃO PAULO EN EL PERÍODO DE 2017-2018

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## ABSTRACT

**Objectives:** To evaluate the epidemiological profile of patients with spinal fractures over a two-year period (2017 and 2018) in a quaternary hospital in the city of São Paulo. **Methods:** A cross-sectional study was carried out through the analysis of the electronic medical records of patients treated by the Spine group of the Department of Orthopedics and Traumatology at the Orthopedics and Traumatology Emergency Room of Hospital das Clínicas de São Paulo in the years 2017 and 2018. **Results:** A total of 185 patients were evaluated over two years. Males were the gender most frequently evaluated (69.19%), and the mean patient age was 43.95 years. The most common trauma mechanisms were falls from a height (45.95%) and traffic accidents (29.73%). The cervical spine, affected in 28.65%, was the most affected region, followed by the thoracolumbar region (26.56%). Most patients did not present deficits at the initial moment (71.89%) and 54.05% of patients underwent surgery for treatment. **Conclusion:** Most traumas involving the spine affect adults of working age (from 20 to 60 years old), with a predominance of males. Most injuries occurred in the cervical region, which is the region most commonly associated with severe trauma and neurological injuries. This study can help in planning prevention and precaution strategies for spinal trauma. **Level of evidence III; Cross-sectional study.**

**Keywords:** Spinal Fractures; Spinal Cord Trauma; Neurologic Deficits; Epidemiology; Spine.

## RESUMO

**Objetivos:** Avaliar o perfil epidemiológico dos pacientes com fraturas da coluna vertebral no período de dois anos (2017 e 2018) em hospital quaternário da cidade de São Paulo. **Métodos:** Foi realizado um estudo transversal mediante análise dos prontuários eletrônicos de pacientes atendidos pelo grupo de Coluna do Departamento de Ortopedia e Traumatologia no Pronto Socorro de Ortopedia e Traumatologia do Hospital das Clínicas de São Paulo nos anos de 2017 e 2018. **Resultados:** Um total de 185 pacientes foram avaliados ao longo de dois anos. O sexo masculino foi predominante na avaliação (69,19%), e a média de idade dos pacientes foi de 43,95 anos. Os mecanismos de trauma mais comuns foram queda de altura (45,95%) e acidentes de trânsito (29,73%). A coluna cervical, acometida em 28,65%, foi a mais afetada, seguida pela região toracolombar (26,56%). A maioria dos pacientes não apresentava déficits no momento inicial (71,89%) e 54,05% dos pacientes foram submetidos a cirurgia para o tratamento. **Conclusão:** A maioria dos traumas envolvendo a coluna vertebral acometem a população economicamente ativa (dos 20 aos 60 anos), com domínio no sexo masculino. A maioria das lesões ocorreram na região cervical, que é a região mais comumente associada a traumas graves e lesões neurológicas. Este estudo pode ajudar a planejar estratégias de prevenção e precaução dos traumas da coluna vertebral. **Nível de evidência III; Estudo transversal.**

**Descritores:** Fraturas da Coluna Vertebral; Traumas da Medula Espinal; Déficits Neurológicos; Epidemiologia; Coluna Vertebral.

## RESUMEN

**Objetivos:** Evaluar el perfil epidemiológico de pacientes con fracturas de columna vertebral en un período de dos años (2017 y 2018) en un hospital cuaternario de la ciudad de São Paulo. **Métodos:** Se realizó un estudio transversal mediante el análisis de historias clínicas electrónicas de pacientes atendidos por el grupo de Columna Vertebral del Departamento de Ortopedia y Traumatología de la Sala de Emergencias de Ortopedia y Traumatología del Hospital de Clínicas de São Paulo en 2017 y 2018. **Resultados:** Se evaluó a un total de 185 pacientes durante dos años. En la evaluación predominó el sexo masculino (69,19%), siendo la edad promedio de los pacientes de 43,95 años. Los mecanismos traumatológicos más frecuentes fueron las caídas de altura (45,95%), seguidos de los accidentes de tráfico (29,73%). La columna cervical, afectada en un 28,65%, fue la más afectada, seguida de la región toracolombar (26,56%). La mayoría de los pacientes no tenían déficits al inicio del estudio (71,89%) y el 54,05% de ellos fueron sometidos a cirugía para su tratamiento. **Conclusión:**

Study conducted at Instituto de Ortopedia e Traumatologia do Hospital das Clínicas of the School of medicine of Universidade do Estado de São Paulo, São Paulo, SP, Brazil.

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La mayoría de los traumatismos que involucran la columna afectan a la población económicamente activa (20 a 60 años), con predominio del sexo masculino. La mayoría de las lesiones se produjeron en la región cervical, que es la región más comúnmente asociada a los traumatismos graves ya las lesiones neurológicas. Este estudio puede ayudar a planificar estrategias de prevención y precaución de los traumatismos de la columna vertebral. **Nivel de evidencia III; Estudio transversal.**

**Descriptor:** Fracturas de Columna Vertebral; Lesiones de la Médula Espinal; Déficit Neurológicos; Epidemiología; Columna Vertebral.

## INTRODUCTION

Spinal fractures and traumatic spinal cord injuries are conditions that produce a considerable socioeconomic impact. The economic impact is due to the high cost of treatment, prolonged hospital stays and rehabilitation time, and the loss of productive life years resulting from sequelae such as paraplegia or quadriplegia.<sup>1</sup> In terms of social impact, these conditions have a detrimental effect on independence and functional capacity, with changes in family dynamics and quality of life/life expectancy, mainly due to respiratory complications.<sup>2</sup>

Traumatic spinal injuries involve isolated or combined injuries of the following structures: spinal cord, bone structures and intra-vertebral disc/ligament components.<sup>3</sup> Spinal cord injury may be associated with partial or complete neurologic deficit, representing a fraction of the complex traumatic spinal injury.

Traumatic spinal injuries have a varied distribution in studies, with some presenting a bimodal pattern<sup>1,4</sup> while others present a unimodal pattern.<sup>5,6</sup>

There are various mechanisms of injury, the most common ones being car accidents and falls from height.<sup>3,7</sup> Other mechanisms of injury, which vary according to the particularities of each region analyzed, are sports activities,<sup>5,8</sup> pedestrian traffic accidents<sup>9</sup> and gunshot wounds.<sup>9</sup> Moreover, spinal trauma occurs more frequently in countries with a low or mid-range income per capita, with 13.7 cases per 100,000 inhabitants in these countries as compared to 8.7 cases per 100,000 inhabitants in high-income countries.<sup>3</sup> Spinal trauma is seen mainly in young adults with an average age of 39.8 years, directly affecting the economically active population. In the sex-based comparison, there is a predominance of cases among males,<sup>10</sup> with the highest ratio of this comparison being found in a Brazilian study, which demonstrated a male to female ratio of 7.35:1 in cervical spinal injuries.<sup>11</sup>

In 2018, in a systematic review of the global incidence of traumatic spinal injuries, Kumar et al.<sup>3</sup> analyzed 102 studies, of which only four were from Latin America. In addition, of the 19 studies selected for a meta-analysis, none belonged to this region.

Corroborating the above information, there are few epidemiological studies on spinal fractures and trauma in Brazil. One of these is a systematic review conducted by Botelho et al. in 2014,<sup>9</sup> which assessed the epidemiology of spinal injuries in Brazil, through an analysis of 14 studies carried out in the five Brazilian macroregions. The most recent study was conducted by Lomaz et al.<sup>12</sup> at a high complexity university hospital located in Uberlândia, an inland city in the state of Minas Gerais, and enrolled 202 participants over a six-year period.

Our objective was to assess the epidemiologic profile of spinal fracture patients who were admitted to the Orthopedics and Traumatology Emergency Treatment Unit of Hospital das Clínicas de São Paulo between January 1, 2017 and December 31, 2018.

## METHODS

A cross-sectional study was carried out through an analysis of the electronic medical records of patients referred via transfer and treated in the Orthopedics and Traumatology Emergency Treatment Unit of Hospital das Clínicas de São Paulo who had sustained traumatic spinal injuries and fractures in 2017 and 2018.

All the referred patients who were assessed, of all ages and with any trauma involving the spine, were enrolled into the study. Patients who arrived at the unit without a referral from another healthcare facility were excluded from this study. The data were all collected from the records of patients treated by the spine group of

the Instituto de Ortopedia e Traumatologia do Hospital das Clínicas de São Paulo. The study was approved by the institutional review board under CAAE number 35375620.1.0000.0068 and with opinion number 4.225.659.

Personal details (age and sex), information about the mechanism of injury (falls from height, traffic accidents, falls from standing height, gunshot wounds, diving in shallow water, traumatic brain injury and others) were collected from the electronic medical records of each patient. The collected data also included the affected spinal regions (cervical – C1 to C6 injuries, cervicothoracic – C7 and T1 injuries, thoracic – T2 to T11 injuries, thoracolumbar – T12 and L1 injuries, lumbar – L2 to L5 injuries and sacral – S1 injuries), neurological status (presence or absence of neurologic deficit based on the Frankel scale) at the time of the patient's baseline assessment, and whether or not surgery was required.

The statistical analysis of continuous data was performed using the mean and the standard deviation. Categorical data will be shown as absolute values with their frequencies and percentages. The entire statistical analysis was carried out using Microsoft Excel software.

## RESULTS

The study group assessed included a total of 185 patients: 128 (69.19%) male and 57 (30.81%) female. The ratio of male to female patients was approximately 2.25:1.

The average age of the patients on the date of the traumatic injury was 43.95 years (7-87 years), with a standard deviation of 16.70 years. The average age of the male patients was 43.43 years (14-87 years), while that of the female patients was 45.10 (7-83 years). In the male patients, we observed a concentrated distribution among patients aged between 19 and 60 years, while in the female patients, we found two peaks of involvement, one between 19 and 50 years and the other in patients over 60.

Among the female patients, the highest frequency was found in patients over 61 years (16 patients), while in male patients the highest frequency was in patients aged between 41 and 50 years and between 51 and 60 years (with 28 patients in both age brackets) – Table 1.

The most common mechanism of injury was falls from height with 85 cases (45.95%), followed by traffic accidents with 55 cases (29.73%). The third most common mechanism of injury was falls from standing height with 29 cases (15.68%). Other causes (diving into shallow water, gunshot wound, traumatic brain injury (TBI), direct trauma or others) represented 16 cases (8.65%), and only two patients presented with TBI alone – Figure 1.

Among the 185 patients assessed, we found 192 cases of injury, with seven patients presenting with multiple injuries and two patients without any injuries. In terms of anatomical region, the most frequently injured site was the cervical spine with 55 cases (28.65%), followed by the thoracolumbar region with 51 cases (26.56%), the lumbar region with 41 cases (21.35%), and the thoracic spine with

**Table 1.** Distribution of patients by age x sex.

	Male	Female
<18 years	3	6
19-30 years	25	9
31-40 years	27	11
41-50 years	28	9
51-60 years	28	6
>61 years	17	16

37 cases (19.27%). The least affected areas were the cervicothoracic region with five cases (2.61%), and the sacral region in three cases (1.56%) – Figure 2.

We identified neurologic impairment in 51 patients (27.57%) at baseline. We were only unable to carry out the assessment of one patient, due to lack of collaboration. Distribution using the Frankel classification tool was as follows: Frankel A (24 cases – 12.97%), Frankel B (8 cases – 4.32%), Frankel C (8 cases – 4.32%), Frankel D (11 cases – 5.95%) and Frankel E (133 cases – 71.89%) – Figure 3.

Finally, in the total group of 185 patients assessed over the period, surgical treatment was the most common outcome, having been chosen in 100 patients (54.05%), while the remaining 85 patients (45.95%) underwent nonsurgical treatment.

**DISCUSSION**

The objective of this analysis was to present an overview of the epidemiological characteristics of patients assessed by the group of spine surgery specialists over a two-year period (2017 and 2018 biennium). Although our hospital is classified as high complexity, we receive numerous self-referred patients in our emergency unit.

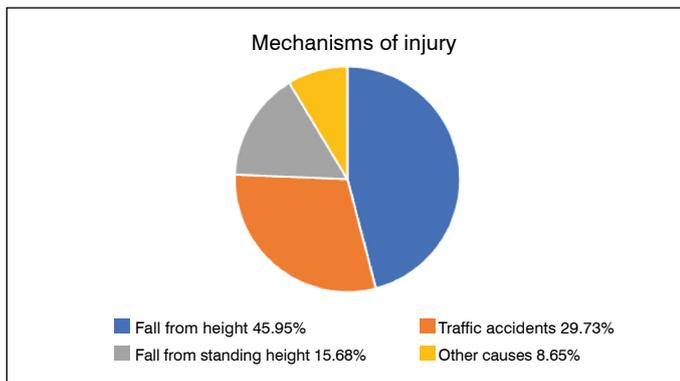


Figure 1. Distribution of cases by mechanism of injury.

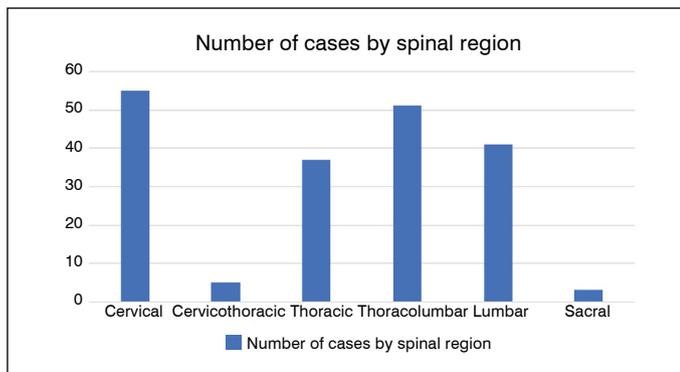


Figure 2. Number of cases by spinal region.

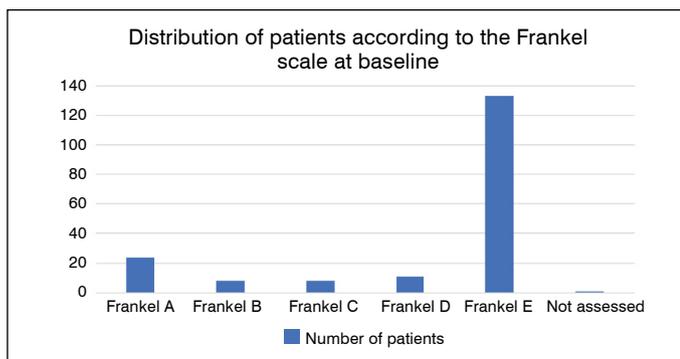


Figure 3. Distribution of patients according to the Frankel scale at baseline.

However, these patients did not form the scope of our research, as only patients referred from other institutions or facilities that did not have spine surgery specialists available to perform a detailed assessment were included in the study. Accordingly, patients with more severe injuries may be overrepresented in this study.

Of the total group of 185 patients assessed in our study, there was a predominance of male patients representing 69.19% of cases. Leucht et al.,<sup>13</sup> when assessing cases in a level 1 hospital in Germany, found a frequency of 61.03% male patients, while Hasler et al.<sup>14</sup> found a predominance of 64.94% male patients. In a study in China,<sup>7</sup> male patients represented 65.50% of cases, while in another study in the Netherlands, male patients accounted for 59.2% of cases.<sup>15</sup> Botelho et al.,<sup>9</sup> in their systemic review of the epidemiology of traumatic spinal cord injuries in Brazil, reported that 84% of patients were male. In a literature review, a predominance of male patients was observed in all the studies.<sup>1</sup>

The sex ratio in our study was 2.25:1, with a predominance of male patients. Wang et al.<sup>7</sup> found a male to female ratio of 1.9:1, while den Ouden et al. found evidence of a 1.5:1 ratio.<sup>15</sup> This ratio is within the expected range of 1:1 to 7.59:1 for underdeveloped countries.<sup>1</sup>

We can attribute this unequal distribution between sexes to the fact that men work in jobs with a higher risk of occupational accidents, tend to be less careful when driving, and spend their leisure time in places where they are more prone to accidents. Regarding these leisure-time accidents, Botelho et al.,<sup>9</sup> actually mentions falls from height (mainly from roofs) as a public health problem, and attributes this higher risk to the suburban housing characteristics in the large Brazilian urban centers.

In our study, the main mechanisms of injury were falls from height (45.95%), traffic accidents (29.73%) and simple falls from standing height (15.68%), respectively. The same frequency sequence of falls from height and traffic accidents as the two primary causes was also found in other studies.<sup>3,7,13,15,16</sup> The results are consistent with another published study carried out in Brazil.<sup>9</sup> The low number of patients with isolated TBI found in our study is due to the fact that this mechanism of injury is generally associated with higher energy trauma and multiple associated injuries, with this patient continuing to receive care at another institute within the hospital complex (where there is a neurosurgery team and other surgical specialties).

The average age of the patients at the time of trauma was 43.95, which is in line with the literature.<sup>1,3,7,13,14</sup> Botelho et al.,<sup>9</sup> found an average age of 34.75 years through a systematic review of various studies carried out in Brazil. The average age of the patients affected by spinal cord injuries in underdeveloped countries ranged from 29.5 to 46 years.<sup>1</sup>

In our study, the average age of the male patients was 43.43 years while that of the female patients was 45.10 years. In a Dutch study,<sup>15</sup> the average age was 48.90 years for males and 56.40 years for females.

We found two peaks of involvement in the female patients, with a notable predominance in patients aged over 61 years, where a simple fall from standing height was responsible for half of the trauma cases in patients from this subgroup. Among males, however, we observed a more uniform distribution, with the majority consisting of young adult patients aged between 19 and 60 years. These findings are compatible with those found in the literature.<sup>13</sup>

The cervical spine was the most commonly affected region, with 55 injuries (28.65%), followed by involvement of the thoracolumbar spine (26.56%), a result similar to that of the study by Botelho et al.,<sup>9</sup> who identified cervical injuries in 36.65%. This is also the most common region and is compatible with other studies.<sup>1,3,16</sup>

Leucht et al.,<sup>13</sup> found a higher frequency of lumbar spine involvement (50.4% of cases), as did Hasler et al.,<sup>14</sup> (37.09% of involvement of the lumbar region) and Wang et al.,<sup>7</sup> (47.81% of involvement of the lumbar region). The difference between these figures may be related to the fact that we have categorized thoracolumbar fractures (T12 and L1) as a distinct group, while there was no such separation in these other studies, in which the most frequently fractured vertebra was L1.<sup>7,13</sup> In a single study we found that the thoracic spine had the highest level of involvement (41.6%).<sup>15</sup>

In seven patients we observed injuries at multiple levels (3.78% of cases). In a European cohort study,<sup>14</sup> the frequency of multiple injuries was 10.35%, while in a Chinese study this frequency was 11.87%.<sup>7</sup>

In our study, the vast majority of patients were admitted to the facility without neurologic deficits (71.89%). Complete neurologic deficit (Frankel A) was the second most common profile found at baseline (12.97%). The findings are compatible with those reported by Leucht et al.<sup>13</sup> in a study that graded 75.3% of patients as Frankel E and 11.2% as Frankel A. Wang et al.,<sup>7</sup> provided evidence of neurologic deficit in 44.30% of patients, with Frankel D (19.86%) and Frankel A (15.25%) being the most frequent gradings. In the review by Botelho et al.,<sup>9</sup> patients classified as Frankel A represented 34%. We believe that this difference in relation to our findings can be attributed to the socioeconomic and cultural differences of each Brazilian region.

As the outcome of our assessment, we found that surgical treatment was the procedure of choice for 100 patients (54.05%). In a systematic review carried out by Kumar et al., surgical treatment was chosen in 36.6% of patients with traumatic spinal injuries, while in

patients with traumatic spinal and spinal cord injuries, surgery was performed in 48.8% of cases. Den Ouden, in turn, treated 83.8% of cases non-surgically compared to 16.2% surgical treatments.

## CONCLUSION

Spinal injuries reflect a problem with considerable potential to entail financial and social cost, widely affecting adults of working age who need to be treated as a priority by public health. Spine-related injuries have the worst functional outcomes and the lowest rates of return to work of all systemic organ injuries.<sup>7</sup> Gaining an understanding of the factors involved in this process, and the consequences of injuries, is of paramount importance when planning public health promotion and prevention strategies.

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All authors declare no potential conflict of interest related to this article.

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