

## Retrospective Analysis of Patients with Cervical Spine Injuries Submitted to Surgical Intervention in A Tertiary Hospital in São Paulo

Luiz Cláudio Lacerda Rodrigues <sup>1\*</sup>, Fernanda Andrea Minutti Navaro <sup>2</sup>,  
Rodrigo Yuiti Nakao <sup>3</sup>, Nathalia Adelina Neves Justino Pereira <sup>4</sup>

<sup>1</sup> Head of the Orthopedic Discipline Santa Marcelina School Of Medicine, Brazil

<sup>2,3</sup> Department of Orthopedics and Traumatology, Hospital Santa Marcelina, Brazil

<sup>4</sup> Medical Student, Santa Marcelina School of Medicine, Brazil

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**\*Corresponding author:** Luiz Cláudio Lacerda Rodrigues, Head of the Orthopedic Discipline Santa Marcelina School Of Medicine, Brazil.

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### Abstract

We here retrospectively analyzed patients who suffered from cervical spine injuries and were submitted to surgical treatment in a tertiary hospital in the East region of São Paulo, an area with a high incidence of trauma in the city.

Between January 2007 and December 2016, data about 44 patients were collected, and the parameters assessed were age, gender, type of lesion, mechanism of trauma, vertebral level of lesion, spine levels surgically addressed, year of occurrence, type of surgery performed, cause of trauma, neurological status according to the Frankel scale and incidence of immediate complications.

The main cause of cervical spine fractures are car accidents, followed by high falls. The patients were male gender (72.7%) in most cases.

The principal factor causing cervical spine fractures are accidents with automotive vehicles, followed by high falls. Most of the cases occurred to male gender patients (72.7%).

We verified that prevention measures can be taken to diminish the severity of cervical spine trauma and thus, sequels and rehabilitation time of the victims, especially in large urban centers in which mobility mainly involves cars, the factor most frequently related to this type of lesion.

**Key Words:** cervical spine; spinal injuries; surgery; trauma

### Introduction

Traffic accidents caused the death of 35.3 mil people in 2017 [1]. Most of the fatal victims are male and young, at productive age, between 20 and 39 years old. These data are relevant seeing that these thousands of premature deaths occur every year and have a great social and economic impact both on the health sector and on the families.

IBGE [the Brazilian Institute of Geography and Statistics] data report that, in 2010, the city of São Paulo had 11.25 million inhabitants, and counted on a fleet of 27.5 million vehicles. The East region alone has a 3.6-million population, and is therefore considered a densely populated region, which leads to a high incidence of domestic and of car accidents, hence generating a large number of victims of traumas. [1,2].

Cervical spine injuries are among the major causes of death in that population, and when the injuries do not cause death, they may lead to severe sequels. The need for medical care and treatment to lesions in this region have increased, especially due to an increase in the number of high-impact accidents, besides being associated to high-cost treatment, which may involve hospitalization, surgical interventions and rehabilitation; furthermore, it may interrupt the victims' careers.

Among the vertebral spine lesions, fractures are important causes of morbidity and mortality [4].



Significant is the number of medical assistances due to lesions located in the cervical segment, mainly due to the increase in car and high-energy accidents [3,5]. Patients with this type of lesion may evolve to irreversible sequels, such as tetraplegia, hemiplegia, paraplegia, besides death [5,6,7].

The different regions, for their demographic and social-cultural characteristics, present variable incidences of spinal trauma [6,7]. It is therefore important to conduct a survey into the factors related to the types of trauma in each population so as to devise a planning and prevention strategy locally directed to health and medical care [6,7,8].

The incidence of brain injury may reach 40% in cervical spine fractures, being more frequent in male patients, due to their greater exposition to high-energy car accidents, urban violence, high falls and diving in shallow waters [5,10,11]. In the United States, a developed country, about 40 inhabitants per million suffer vertebral spine trauma; of these, 15% to 20% evolve to brain injuries, despite their expertise in emergency care as a first-world country [5].

These numbers, associated to the high economic and social costs deriving from these patients' treatment and rehabilitation, make vertebral lesion a critical public health problem [5,12,13,14].

Therefore, studying the causes and epidemiology of cervical spine injuries can provide a better preparation of the team of the local hospital of reference for trauma, allowing the organization of a protocol of conduct for the team that will approach patients that may be admitted with such lesions.

Moreover, a survey of the clinical-epidemiological profile of the cases cared for may be beneficial to determine the need for implementing prevention and assistance policies to the victims of cervical spine fractures,

## Objectives

Performing a retrospective analysis of patients with lesion in the cervical spine submitted to surgical treatment in a tertiary hospital in the East region of São Paulo to define an etiological pattern of the patients victims of trauma in the East region of São Paulo.

## Materials and Methods

### Study outline

A retrospective study was conducted, analyzing clinical and epidemiological data of the patients assisted in a tertiary service, in a pre-defined period, from January 2007 to December 2016. The following variables were assessed: age, gender, type of lesion, mechanism of trauma, the vertebral level injured, vertebral levels surgically approached, year of the occurrence, type of surgery performed, neurological status according to the Frankel grade and incidence of immediate complications.

The data collected were tabulated and analyzed, searching for associations or relevant correlations. Also taken into consideration was the statistical significance. The information contained in the database was stored and analyzed using the SPSS 2011 software.

### Patients

The study included all the patients surgically approached due to fractures of the cervical spine in a tertiary hospital, between 2007

and 2016. They had their medical records thoroughly examined, and were later summoned for interview, for a better data collection and physical examination. Their lesions were classified and data on the surgical treatment performed were collected. In the medical records, we searched for data regarding the origin, mechanism of trauma, type and level of the lesion, Frankel grade, treatment proposed and clinical complications regarding the trauma, besides the necessary patients' personal data. All the patients were previously contacted. We included solely the patients or the next of kin that had agreed to participate in the study and had read and signed the Free and Informed Consent Form (FICF) for the study.

As inclusion criteria, we delimited the patients victims of fracture of the cervical segment due to trauma, surgically treated by the team of vertebral spine pathologies of the Orthopedics and Traumatology Department of Hospital Santa Marcelina between 2007 and 2016.

We did not include patients with fractures by stress, osteopenia deriving from tumors or from non-traumatic causes, patients surgically approached in other hospitals or patients for whom non-surgical or conservative treatment had been chosen.

## Results

We present the frequency and the percentage of the cases included in the study in Table 1, classified by year. A total of 44 patients were included, being 32 male (72.7%) and 12 female (27.3%). As regards the patients' age, from the medical records data, ages between 14 and 66 were observed, yielding an average of 42.3 years. Out of the 44 patients, 29 (65.9%) were cared for through the Sistema Único de Saúde [the Brazilian Unified Health System] and 15 (34.1%) by the supplementary health system.

Regarding the type of trauma, 26 (59%) fractures and 18 (40.9%) dislocations were classified. The assessment of the levels injured was divided individually by vertebra. We found 23 (52.3%) cases of C5 lesion; 8 (18.2%) cases of C6 lesion; 8 (18.2%) cases of C4 lesion; 2 (4.5%) cases of C2 lesion; and 1 (2.3%) case of C7 lesion. We also observed the occurrence of 2 (4.5%) cases of lesion in 2 or more levels. No cases of C1 and C3 lesion occurred. Table 2 presents the average age of the patients affected by each level of lesion.

As regards surgical approach in the patients of the study, the levels approached were: 13 (29.5%) cases of C5-C6; 11 (25%) cases of C4-C6; 4 (9.1%) cases of C3-C5; 4 (9.1%) cases of C4-C5; 4 (9.1%) cases of C5-C7; 3 (6.8%) cases of C6-C7; 1 (2.3%) case of C2-C3 approach; also found were 4 (9.1%) other types of approach.

Among the procedures applied, 14 (31.8%) cases were of anterior arthrodesis with disc Cage; 20 (45.5%) cases of anterior Corpectomy; 9 (20.5%) cases of 360-degree arthrodesis and 1 (2.3%) case of fixation with anterior screw.

As to the mechanism of trauma, based on the Allen-Fergusson classification, 22 (50%) cases of Flexion-Compression were observed, besides 17 (38.6%) cases of Flexion-distraction; 4 (9.1%) cases of Lateral Compression, 1 (2.3%) case of another type of mechanism, the latter not fitting the classification.

According to the Frankel grade for neurological status, we found 34 (77.3%) cases of Frankel E; 1 (2.3%) case of Frankel D; 1 (2.3%) case of Frankel C; 8 (18.2%) cases of Frankel A. There



were no reports of cases classified as Frankel B.

Regarding the factor causing the trauma, the following were observed: 32 (72.7%) cases due to car accidents; 5 cases (11.4%) due to high fall; 4 (9.1%) cases due to motorcycle accident and 3 (6.8%) cases due to domestic accidents. No occurrence of immediate complications was observed in any of the 44 cases analyzed

## Discussion

The study assessed the incidence and etiology of cervical lesions in 44 patients submitted to surgical treatment in a tertiary hospital of the East region of São Paulo. From the data derived, we inferred that the patients mostly affected by these lesions are young adult males, at productive age, agreeing with other data regarding the epidemiology of spinal fractures [6,15]. An average age close to that found in previous works was obtained, of 42.3, coinciding with the range demonstrated in previous reports, the peak of which varies from 30 to 50 years [15].

The etiology of the accidents is also concordant when compared to other studies, car accidents being the major cause of cervical spine fractures, corresponding to 72.7% of the cases [6,7], whereas falls represent only 11.4% of them. Studies conducted in other countries may differ from the results herein, as is the case of China, the studies of which demonstrate that car accidents correspond to 33.6% of the patients with spinal injuries [6]. This discrepancy among regions may be related to divergent educational and safety measures, besides the culture in the regions, and their urban structure.

The data herein demonstrated that the main target of cervical spine injuries is the adult population, majorly male, largely highlighted by the statistics regarding trauma, since 75% of car accident victims are of the male gender, as are 60% of high fall ones.

Traumatic injuries are the major cause of death and morbidity among young adults [16]. Peng Liu et al. present results similar to ours in relation to gender and to the average age, reporting that men with an average age of 40 are the population under the higher risk [6].

Surveys into neurological deficit due to trauma demonstrated that 35% of the patients present some degree of damage [16]. In our work, we observed a total of 22.8% of cases with some or total neurological alteration when adding cases classified into Frankel A, B, C and D. Moreover, we observed that the average age for fracture cases was below that found for dislocations, being 40.5 for fractures and 44.7% for dislocations.

Koch et al. carried out a study at the Hospital do Trabalhador in Paraná. They surveyed all the types of fractures of the vertebral spine, besides gunshot wounds, and provided data similar to ours, with a predominance of accidents by fall in 51% of the cases and 32% of car accidents, falls being related to a larger number of surgical interventions [16].

Campos et al. performed an epidemiological analysis in the South region of the city of São Paulo, including all the segments of the vertebral spine, without relative differentiation regarding treatment. In their work, the prevalence of the mechanism of trauma diverges from our study, since falls accounted for 40% of the causes of fractures. Yet the predominance of occurrences in the male gender was verified, as in our analysis, 86% of the victims being male [17].

In another study conducted in Hospital Mário Covas, in the São

Paulo Metropolitan Region, Gonçalves et al. raised the epidemiology of patients with spinal cord injury. In it, we observed that the data are recurrent, there being a high prevalence of high fall as the major cause of spinal cord injury, with a total of 47% of the cases assessed. Car accidents, in this case, are the second major cause. Moreover, corroborating our work, it also reveals a predominance of such problems in the male gender [18]. Although we have not accounted for immediate complications after traumatic injuries, previous works found up to 60% of their occurrence [19,20,21]. which is also probably due to a larger sample number.

From the data obtained, we built up the risk profile for traumatic cervical lesions in the region is question, data which, associated to other data obtained in previous studies, may help to devise the ideal cost target, taking into considerations the initial approach, date of hospital admission and discharge, among other variables [22,23]. With these data in hand, the discourses and approaches for the family and for the very patients can be better elaborated, aiming to provide the most adequate and credible information possible regarding the patient evolution [24].

For living in a region of low socioeconomic status, the local population is observed to be constantly in contact with the region lack of structure, which also derives from poor education. Roads with poor maintenance, as well as the poor state of the vehicles used by this population, cause a substantial number of accidents, be it for technical failure or lack of safety items.

We also observe there is a massive deficit of information for raising awareness about the risks and about the devastating sequels this type of trauma may generate. We suggest prevention measures are implemented so as to guide the population, since trauma prevention is the best therapeutic possibility/ alternative. We therefore suggest that intervention by the Government, be it by control policies or by improving education with guidance programs, could really reduce the number of accidents and, consequently, the costs involved in health care, rehabilitation and social security. Moreover, this could prevent the interruption of the professional life of those at a financially productive stage, seeing that young adults represent the majority of the victims in our work and in all the other studies cited from the literature collected.

## Conclusion

The incidence of cervical lesions in the East region of São Paulo is high and is mainly associated to accidental causes. The risk profile concerns young men, victims of car accidents. Different causes were observed for that, most of which related to car accidents. We observed that young men constitute a profile that, in general, presents a greater trend towards not abiding by the traffic code or safety rules.

**Conflict of Interest:** No potential conflict of interest was reported by the authors of this work.

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