ABSTRACT

Objective: To analyze the epidemiological profile of patients with spinal fractures and the characteristics of the population at risk attended at a university hospital. Methods: The study population is composed of 202 patients diagnosed and treated for vertebral fracture due to trauma. The variables were correlated with each other and the correlations with p<0.05 were considered statistically significant. Results: The ratio of incidence of trauma between the sexes was 3:1 for males. The mean age was 37 years and the age group with the highest incidence was between 20 and 39 years. Traffic accidents were the most frequent mechanism (51.2%) and secondly, falls (33.2%). There was a statistical correlation between trauma mechanisms to age group and region of the spine. The first lumbar vertebra (L1) fracture alone accounted for 21.5% of all cases studied associated with the fall mechanism. Spinal cord injury was recorded in 33.7% of the individuals in the sample. A total of 57.3% of the patients were submitted to surgical treatment and 41.7% to the conservative treatment. The mean hospitalization time was 15 days. Conclusions: Spinal fractures are important determinants of morbidity and mortality in the population with a major impact on economically active individuals, especially males. They are directly associated to traffic accidents in the young population and to falls in the higher age brackets. Primary prevention of trauma is the main mechanism for change in this scenario.

Keywords: Spinal injuries; Epidemiology; Spinal fractures; Spine; Accident prevention.

RESUMO

Objetivo: Analisar o perfil epidemiológico dos pacientes com fratura da coluna vertebral e as características da população de risco atendida em um hospital universitário. Métodos: A população do estudo é composta de 202 pacientes diagnosticados e tratados por fratura de vértebras devido à trauma. As variáveis foram correlacionadas entre si e consideradas estatisticamente significativas as correlações com p < 0.05. Resultados: A relação da incidência do trauma entre os sexos foi 3:1 para o sexo masculino. A média de idade foi 37 anos e a faixa etária de maior incidência entre 20 e 39 anos. Os acidentes de trânsito foram o mecanismo de mais frequente (51,2%) e em segundo lugar, as quedas (33,2%). Houve correlação estatística dos mecanismos de trauma conforme faixa etária e região da coluna vertebral. A fratura de primeira vértebra lombar (L1) representou sozinha 21,5% de todos os casos estudados associados ao mecanismo queda. A lesão raquimedular foi registrada em 33,7% dos indivíduos da amostra. Um total de 57,3% dos pacientes foi submetido a tratamento cirúrgico e 41,7% ao conservador. O tempo de internação médio foi de 15 dias. Conclusões: As fraturas de coluna são importantes determinantes de morbidade e mortalidade da população, com impacto principal nos indivíduos economicamente ativos, sobretudo do sexo masculino. Estão diretamente associadas a acidentes de trânsito na população jovem e a quedas nas faixas etárias maiores. A prevenção primária do trauma é o principal mecanismo para mudança desse cenário.

Descritores: Traumatismos da coluna vertebral; Epidemiologia; Fraturas da coluna vertebral; Coluna vertebral; Prevenção de acidentes.

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INTRODUCTION

Although spinal fractures account for only a small percentage of all fractures, their occurrence has significant socioeconomic impacts, even more serious in patients who are victims of radiculomedullary trauma (RMT). The functional independence, family dynamics, and quality of life of these patients are compromised.\(^2\)\(^3\)

Studies in different countries show that there is a higher incidence of spinal fractures in the young male population. In addition, they are mainly associated with traffic accidents and falls from heights.\(^2\)\(^3\) The same epidemiological pattern is maintained in patients with spinal cord injuries, with an annual incidence of approximately 19.4 patients per million inhabitants in France, 10.7 in Germany, 38.4 in the USA, and 21.0 in Brazil.\(^6\)\(^8\) There is dearth of epidemiological studies about spinal fractures in Brazil.

Patients with spinal fractures have prolonged hospitalizations and high immediate treatment and long-term follow-up costs.\(^9\) As a consequence, great expenses are generated for national health and social security systems.

The estimated cost for an individual with spinal injury ranges from $1.5 million for incomplete paraplegia to $3 million for complete quadriplegia.\(^10\) A spinal fracture is also a well-established predictor of subsequent new fractures of the spine in the same individual.\(^11\)\(^12\) With medical costs for patients with a new fracture during the first year of follow-up of $5906 and $3670 in the USA and in Sweden, respectively.\(^13\)

Because there is a higher incidence in the economically active population, the economic impacts increase. There are reductions in functional capacity, rehabilitation challenges, difficulties in reentering the workforce, and a reduced life expectancy, especially from respiratory complications.\(^14\)

The objective of this study was to analyze the epidemiological profile of patients with spinal fractures and the characteristics of the population at risk in a Brazilian high-complexity university hospital (UH) that is a regional reference for trauma located in the city of Uberlândia, MG. Included in the objective was a comparison of the study results with those of other studies conducted in other regions of Brazil and of the world.

METHODS

The study population was made up of 202 patients diagnosed with and treated for spinal fracture from trauma during the period from 2008 to 2014 at the Hospital Universitário da Universidade Federal de Uberlândia.

The data were obtained from medical records. Therefore, it was a retrospective, cross-sectional study. Even though it did not involve direct interaction with the patients or disclosure of personal information, the study was submitted to and approved by the Institutional Review Board under registration CAAE 15047713.0.0000.5152.

Variables such as sex, age, trauma mechanism, affected region and vertebra, association with RMT, treatment of choice (surgery X conservative), and hospitalization time were correlated with each other. Correlations with \(p < 0.05\) were considered to be statistically significant. The statistical analyses were conducted using IBM SPSS 22 software. The principal analyses were of the Chi-square type.

RESULTS

The trauma incidence ratio between the sexes was 3:1, with 75.2% of the subjects being male and 24.8% female. The average age was 37 years, the median age was 35 years, and the minimum and maximum ages were 9 and 77 years, respectively. The highest incidence was in the 20 to 39 years of age range with 48% of the cases. Traffic accidents were the trauma mechanism with the highest frequency at 51.2% and, in second place, falls at 33.2% (Table 1).

In relation to the region of the fracture, the distribution was similar for cervical (32.3%), thoracic (30.4%), and lumbar (32.8%) regions. Fractures of the first lumbar vertebra (L1) alone accounted for 21.5% of the total cases studied.

A total of 57.3% underwent surgical treatment and 41.7% were submitted to conservative treatment. The average hospitalization time was 15 days, with a minimum of 1 and a maximum of 180 days. Of the 202 patients, 33.7% presented radiculomedullary trauma (RMT) associated with the spinal fracture (Table 1). RMT was diagnosed in 26.2% of the cervical, 40.3% of the thoracic, and 38.5% of the lumbar spinal fractures. There was no statistical difference between the regions and the occurrence of RMT (\(p > 0.05\)) (Table 2).

When we analyzed the relationship between the occurrence of RMT and the trauma mechanisms, we observed that 31.6% of automobile accidents, 31.9% of motorcycle accidents, and 38.5% of falls involved neurological deficit. (Table 2) However, it was not possible to infer that a particular mechanism favors the occurrence of RMT (\(p > 0.05\)).

Regarding the association between RMT and sex, it was found that 33.9% of the men had RMT, while 36% of the women presented neurological deficit. There was no statistical difference between the groups (\(p > 0.05\)).

In relation to age, the peak of RMT was in the 20 to 39 years of age group with 42.8% of the total cases of RMT followed by the 40-59 years of age group with 41.1% of the total, with \(p > 0.05\) between the groups. There was also no statistical difference in the occurrence of RMT between the groups when separated using the median age (35 years) as the cutoff.

The most common trauma mechanisms were falls (33.2%), car accidents (28.2%), motorcycle accidents (23.3%), and others (15.3%). These four large groups were created for statistical purposes.

More specifically, in the “falls” group, 4.5% were falls from a standing position, while the rest were “from other heights”. Diving in shallow water, gunshot wounds, and being run over were included within the “other traumas” group with 3.3%, 4.4%, and 3.9% of the cases, respectively.\(^13\)

We observed changes in the distribution of the most frequent trauma mechanisms by age group. For example, the 20-39 years of age group, which had the peak incidence of fractures in the population, had traffic accidents as the principal protagonist, made up of automobile (36.1% in the group and 17.6% of the total) and motorcycle (30.9% in the group and 13.5% of the total) accidents. In the 40-59 years of age group, falls played the major role among trauma mechanisms with 54.7% in the group and 17.1% of total fractures (Figure 1). All these differences were statistically significant (\(p < 0.05\)).
Among males, falls were the most frequent (36.6%), followed by motorcycle accidents (23.5%), and car accidents (22.9%). Among females, 47.1% of the traumas resulted from car accidents, while motorcycle accidents and falls had similar frequencies at 21.6% each (Figure 2). We observed a statistically significant difference between the sexes and the trauma mechanisms (p<0.05).

There was no statistically significant difference found between the sexes when analyzing the mechanisms and age groups. For further analysis, we divided the population into two groups using the median age (35 years) as the cutoff. The mechanisms were divided into two groups (traffic accidents and falls) and we analyzed them in relation to differences between the sexes.

Among men younger than the median age, 56.8% had fractures due to traffic accidents (car and motorcycle). After this age, fractures of this type decreased to 36.7%, while falls prevailed at 51.9%. All these differences were statistically significant.

Among the women younger than 35 years of age, traffic accidents predominated (81.5%). In the group above 35, traffic accidents continued to predominate (51.4%), but there was a significant increase in falls (33.3%). The statistical significance was considered to be borderline (p=0.077).

A statistically significant correlation was found between the trauma mechanism and the region of the spinal fracture. For example, 60% of the fractures of the lumbar spine resulted from falls. On the other hand, traffic accidents were responsible for most of the cervical (80.4%) and thoracic (63.5%) spinal fractures. This association continued to be significant even when the traffic accidents were analyzed in two groups separately by automobile and motorcycle accidents (Figure 3).

The most frequently fractured vertebrae in the cervical, thoracic, and lumbar regions were C5, T12, and L1, respectively. Considering the three regions, the first lumbar vertebra accounted for 21.5% of all fractures, followed by T12 (12.5%) and C5 (12%) (Figure 4).

In relation to the distribution of fractured vertebrae and trauma mechanisms, the importance of “falls” in lumbar vertebral fractures stands out, especially in the thoracolumbar transition (T12, L1, and L2). More precisely, falls were responsible for 56% of the fractures of T12, 58.1% of those of L1, and 69.2% of those of L2 (Figure 5).

Automobile and motorcycle accidents stand out as the principal trauma mechanisms of the cervical spine above the fifth vertebra (C5), especially in the upper cervical spine (C1-C3), where traffic accidents are the cause of 66.7% of C1 fractures, 80% of C2 fractures, and 83.3% of C3 fractures and falls were not responsible for any injuries at this level (Figure 5).

There was no statistical correlation between the number of vertebral fractures and the existence of RMT, the mechanism, the age range, or sex (p>0.05).
DISCUSSION

Spinal fractures predominated in the 20 to 39 years of age range, with a peak incidence at 37 years (Table 1) in concordance with already published epidemiological studies. This range practically coincides with the peak of the economically active population (EAP) in Brazil, which is from 25 to 49 years of age (60.9% of the EAP in 2015). Thus, spinal fractures have a great economic impact, since the group with the highest incidence is exactly that of young economically active individuals.

Distribution by sex in this age group also agrees with the 2015 EAP with 53.2% men and 46.8% women. Although men and women have similar proportions of involvement in the labor market, the risk of death at work is a possible way to understand the occupational differences between the sexes. Although it is not possible to define the factors that lead to the occupational differences by sex, it is possible to estimate the impact of the effect: the difference in physical risk among the occupations accounts for around a quarter of this segregation. Thus, the 3:1 ratio of fractures in men in relation to women found in this (Table 1) and in other studies, is probably more related to the type of work performed according to sex than to the relative quantity of men versus women. To date, there are no published scientific studies that test this hypothesis in spinal fractures and new studies are necessary for statistical confirmation.

The incidence of spinal cord injury in spinal fractures observed in different studies ranges from 5.4 to 27.6%. Chu et al. conducted a study involving 51,641 patients with spinal lesions between 2000 and 2003 in which they found an incidence of neurological deficit in 27.6% of the patients. This value was close to, although less than, the 33.7% observed in this study (Table 1). The authors believe that the high incidence of RMT is due to the fact that this work was conducted in a hospital that is a regional reference for high-complexity traumas.

The frequency of RMT was higher in fractures of the thoracic spine and also when the mechanisms were “falls” (Table 2). However, there was no statistical correlation between these variables. Thus, it could not be confirmed that there was a higher risk of RMT from thoracic spinal fractures or when the trauma resulted from a fall. RMT also had no significant correlation with sex, age range, or the median age of the population.

The main mechanisms for spinal fractures were falls, car accidents, motorcycle accidents, falls from a standing position, diving in shallow water, gunshot wounds, and being run over (Table 1). Violent causes continued to be more accentuated in developing countries than in developed countries. There was a statistical correlation between the different trauma mechanisms and the three spinal regions analyzed (Figure 5). The predominance of fractures of the first lumbar vertebra in association with “falls”, as well as that of fractures of the upper cervical spine with traffic accidents, was clear.

In the group between 20 and 39 years of age, that with the peak incidence of fractures in the population, the main protagonist was traffic accidents, specifically automobile accidents. In the group between 40 and 59 years of age, falls assume the main role among trauma mechanisms (Figure 1) in agreement with other epidemiological studies. Thus, with advancing age and the biomechanical changes in the spine, there is a concomitant increase in fractures from falls and a decrease in fractures from traffic accidents as compared to the younger populations. The statistical difference between the age groups is a solid piece of data for driving awareness and prevention campaigns.

We found a statistical difference between sex and trauma mechanism (Figure 2). When sex was analyzed using median age as the cut-off point, men and women up to 35 years of age had a higher probability of suffering spinal fractures due to traffic accidents. In women older than 35, this tendency was maintained, while in men, spinal injuries resulted mainly from falls. Future studies are necessary to clarify the relationship between sex, age, and trauma mechanism.

CONCLUSION

Spinal fractures are important determinants of morbidity and mortality in the population and, considering that the peak incidence occurs in economically active persons, direct and indirect costs are higher. The main measure of impact in this scenario is prevention, given that external causes (trauma) are the most important mechanisms. For this reason, new epidemiological studies are needed to better define the regional prevention priorities.

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

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