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Original contribution

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Frequency of Pediatric Spinal Cord Injury. 9 years experience

Frecuencia de la lesión medular pediátrica en un centro de rehabilitacion. Experiencia de 9 años

Abstract

Introduction: The World Health Organization defines spinal cord injury (SCI) as damage suffered in the spinal cord as a result of trauma: like a car accident, a disease or spinal cord degeneration, as in cancer. There are no reliable estimates of global prevalence; it is estimated that its annual incidence ranges from 40 to 80 cases per million inhabitants. Up to 90% of these cases are due to traumatic causes, although the proportion of non-traumatic SCI seems to be increasing. The SCI in children and young people is rare; however, it generates a significant physical and psychologically impact in the child.

Objective: To establish the frequency and etiology of spinal cord injury in children and adolescents in the CRIT State of Mexico.

Methods: This is a descriptive study of prevalences in which all the records of patients with a medical history of spinal cord injury were reviewed in the *Centro de Rehabilitación e Inclusión Infantil Teletón Estado de México* in the last 9 years. The data included were age, gender, cause of spinal cord injury, topography and neurological level according to the classification of the American Spinal Cord Injury Association (ASIA).

Results: In the spinal cord injury clinic from September 2008 to November 2017, 47 patients with a diagnosis of SCI Were admitted, with age ranging from 9 months to19 years. 27 male/20 female were included. The most frequent cause of SCI were nontraumatic causes in 31 (65.9%) cases, being the tumoral etiology the most representative cause. Traumatic causes were presented in 16 (34%) patients. Of the 47 cases reviewed, due to their clinical presentation, 26 (55.3%) were incomplete and 21 (44.6%) complete.

Conclusions: The etiology of spinal cord injury was non-traumatic in children under 10 years, the most frequent type being complete spinal cord injury.

Keywords

Spinal cord injury, spinal trauma, pediatric rehabilitation.

Resumen

Introducción: La Organización Mundial de la Salud define a la Lesión Medular (LM) como los daños sufridos en la médula espinal: a consecuencia de un traumatismo (accidente automovilístico), una enfermedad o la degeneración de la médula como en el caso del cáncer, no existen estimaciones confiables de la prevalencia mundial; se calcula que su incidencia anual oscila entre 40 y 80 casos por millón de habitantes. Hasta un 90% de esos casos se debe a causas traumáticas, aunque la proporción de LM de origen no traumático parece ir en aumento. La LM en los niños y jóvenes es poco frecuente, sin embargo, genera un impacto significativo a nivel físico y psicológico tanto en el niño, como en su familia y entorno.

Objetivo: Establecer la frecuencia y etiología de la lesión medular en niños y adolescentes en el Centro de Rehabilitación e Inclusión Infantil Teletón Estado de México.

Métodos: Es un estudio descriptivo de prevalencias en el que se revisaron todos los expedientes de pacientes con historia clínica de lesión medular en los últimos 9 nueve años. Los datos incluidos fueron: edad, género, causa de la lesión medular, topografía y nivel neurológico de acuerdo con la clasificación de la American Spinal Cord Injury Association (ASIA de sus siglas en inglés).

Resultados: En la clínica de lesión medular de septiembre de 2008 a noviembre de 2017, ingresaron 47 pacientes con diagnóstico de LM, con un rango de edad entre 9 meses y 19 años. Se incluyeron 27 masculinos y 20 femeninos. Las causas más frecuentes de LM fueron las no traumáticas, presentadas en 31 casos (65.9%) siendo el origen tumoral la causa más representativa, las causas traumáticas se presentaron en 16 pacientes (34%). Los 47 casos analizados, por su presentación clínica fueron 26 (55.3%) LM incompleta y 21 (44.6%) LM completa.

Conclusiones: La etiología de lesión medular fue la no traumática en menores de 10 años, con mayor frecuencia la lesión medular incompleta.

Palabras clave

Lesión medular, trauma medular, rehabilitación pediátrica.

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Introduction

The World Health Organization (WHO) defines spinal cord injury (SCI) as damage to the spinal cord as a result of trauma (such as a motor vehicle accident), a disease (like transverse myelitis), or degeneration of the spinal cord (as with cancer). There are no reliable estimates of global prevalence, but it is estimated that its annual incidence ranges between 40 and 80 cases per million inhabitants. Up to 90% of these cases are due to traumatic causes, although the proportion of non-traumatic origin SCI appears to be increasing. Though the exact frequency of SCI is unknown, between 250,000 and 500,000 people worldwide suffer from SCIs every year according to a WHO report from 2013. It is possible that the actual incidence is higher due to unreported cases of death at the scene of the accident or during transportation to the hospital.[2,7] The WHO reports that, in the United States, SCIs in children under 15 represent less than 4% of the annual incidence of all cases of acquired SCIs.[1] This figure is similar to what Romero and Ramírez report regarding the fact that SCIs in children are relatively rare since they represent between 2 and 5% of all spinal injuries.[9]

In men, the risk of SCI is higher in young adults between the ages of 20 and 29 and in the elderly after the age of 70. In women, on the other hand, the greatest risk is registered in adolescence between the ages of 15 and 19 and after the age of 60. The male-female ratio is at least 2:1, although in some cases it can be higher.[1]

Most SCIs are due to preventable causes such as traffic accidents, falls, or acts of violence. People with SCIs are two to five times more likely to die prematurely than those without. The lowest survival rates are in low- and middle-income countries. SCIs are associated with lower rates of schooling and economic participation.[1]

Spinal cord injuries are rare in children and young people, but they have a significant physical and psychological impact on them as well as on their family and environment.[3] SCIs represent an important cost to those who suffer from them and to society as a whole.[1]

Anatomical and physiological differences in children and adolescents, together with growth and development, are responsible for the manifestations and complications of SCI in the pediatric patient.[3]

This is because the pediatric cervical spine is hypermobile, due to ligament laxity and horizontalization of the facets. In children, Spinal Cord Injury Without Radiographic Abnormalities (SCIWORA) have been found more frequently, conditioned by the relative hypermobility of the spine.9 These peculiarities are due to the different biomechanical behavior of children, especially those under 10 years of age.[7,11]

Pediatric SCI is a little-studied nosological entity, probably due to the scarce information reported worldwide and the little knowledge of its etiology; however, it is one of the reasons for care in child rehabilitation services that requires comprehensive management due to its sequelae and complications.

Materials y methods

This is a descriptive study of prevalence. All patient files with a clinical history of spinal cord injury at the Center for Child Rehabilitation and Inclusion of the State of Mexico in the last nine years were reviewed. Data included were age, gender, cause of spinal cord injury, topography, and neurological level according to the classification of the American Spinal Cord Injury Association (ASIA).

Results

Forty-seven patients with a diagnosis of SCI were admitted at the spinal cord injury clinic from September 2008 to November 2017. They ranged in age from 9 months to 19 years, with an average age of 4 years (Figure 1).

Of the 47 patients analyzed, 23 men and 16 women were included, a ratio of 1.4:1 (Figure 2).

The most frequent causes of SCI were non-traumatic in 31 cases (65.9%). Tumor origin was the most representative cause in 11 patients with a diagnosis of retroperitoneal neuroblastoma, medullary pilocytic astrocytoma. Five cases presented with an infectious origin (transverse myelitis), four cases with neonatal hypoxia, and the last five had multiple vascular origins: arteriovenous malformations (AVM), aortic aneurysms, extradural hematoma and medullary ischemia due to cardiac malformation at birth and coarctation of the aorta (Table 1).

Sixteen patients presented with traumatic causes (34%). Six cases were vertebral fractures secondary to car accidents, five cases of accidents due to falls from heights, three cases of gunshot wound, one was run over by a car, and one obstetric trauma (Table 2).

Of the 47 cases analyzed, 26 were incomplete SCI (55.3%) and 21 were cataloged as complete SCI (44.6%) due to their clinical presentation (Figure 3).

The topographic presentation was in the following distribution: 15 cases of flaccid paraplegia (31.9%), nine of spastic paraparesis (19.1%), eight of spastic paraplegia (17%), five of spastic quadriparesis (10.6%), four of flaccid paraparesis (8.5%), three mixed quadriparesis (6.3%), one double hemiparesis (2.1%), one spastic diparesis (2.1%), and one mixed paraplegia (2.1%) (Table 3).

According to the ASIA classification, 21 patients were classified as type A (44.6%), 13 as type C (27.6%), nine as type B (19.1%), and four as type D (8.5%) (Figure 4).

Discussion

Spinal cord injury in the pediatric and adolescent population is a rare pathological entity in the Mexican population attending CRIT in the State of Mexico. Other origins of motor disability such as cerebral palsy, neuromuscular diseases, or birth defects such as neural tube defects affecting the spine, specifically myelomeningocele, are the main reasons for care.

The population studied in the last nine years with spinal cord alterations was 251 patients, of which only 47 had a diagnosis of SCI (18.7%).

The literature mentioning frequent traumatic causes of SCI include Hagen[4] and Wang[5], reporting that they're associated with car and pedestrian accidents in children and with car and motorcycle accidents in adolescents. Posadas reports 14 cases of child spinal cord trauma of which 50% were caused by traffic accidents and 33.3% by falls from a height in their home. Gunshot wounds and mistreatment were rare.[10]

Costacurta reports that 50.9% had traumatic origin (gunshot 42.6%, run over by a car 9.3%, direct trauma 5.6%), non-traumatic origin 49.1%, tumors 36.5%, infections 19.2%, vascular disease 15.9%, spinal malformations 11.5%, syringomyelia 3.8%, and non-established etiology 13.5%.3

Claret reports in four cases (25%) the cause of SCI was obstetric trauma, in seven of the cases (43.7%) the cause was traumatic: three motorcycle accidents, two traffic accidents, one was run over by a car, and another was a fall. The malformation cause includes two patients (12.5%) affected by a medullary arteriovenous malformation. In three patients (18.7%) the lesion appeared in the immediate postoperative period of spine surgery (one cervical and two dorsal).[7]

Our results differ from those of the authors mentioned since we found that 31 cases of the studied population (65.9%) presented a non-traumatic origin as a cause of the SCI and only

16 patients had trauma as etiology (34%). The inversion of the etiology is probably the result of better prevention of accidents and the specific diagnosis of the diverse nosological entities causing spinal cord damage. This study did not include neural tube defects of vertebral location (myelomeningocele) as part of the etiologies.

Regarding the age of presentation in our research, children under 10 years (59.5%) were the most affected, similar to what is described in the literature. Claret in 2006 reports that out of 16 patients included in the study, 12 were male, with ages between a few hours of life and 19 years eight months, with an average of 10 years.[7] Costacurta et al.[3] on the other hand, conducted a study at the Association of Assistance for Child Disability based in Sao Paulo, Brazil, from April 2002 to June 2008 analyzing 1953 cases of patients, children from 0 to 16 years, 106 patients over 16 years. The frequency of SCI was 5.4%, 63.2% were males, with an average age in males of 8.6 years (mean 9 years). The presentation by gender in our study was predominantly men, similar to what the WHO and Parente mentioned in 2005: out of 86 children who suffered spinal trauma 45 were boys and 41 girls, which represents a ratio of 1.1:1.6

In relation to neurological involvement, 55% of cases result in tetraplegia and 45% in paraplegia below the first thoracic level.[2] Claret also mentions that the most common level was paraplegia with 76.4%.7 Coinciding with the results of this study, 51% presented paraplegia, contrasting with the fact that there were no cases of quadriplegia, but quadriparesis in 17% of the population.

Figure 1. Pediatric Spinal Cord Injury Frequency by Age. Source: CRIT State of Mexico 2008-2017

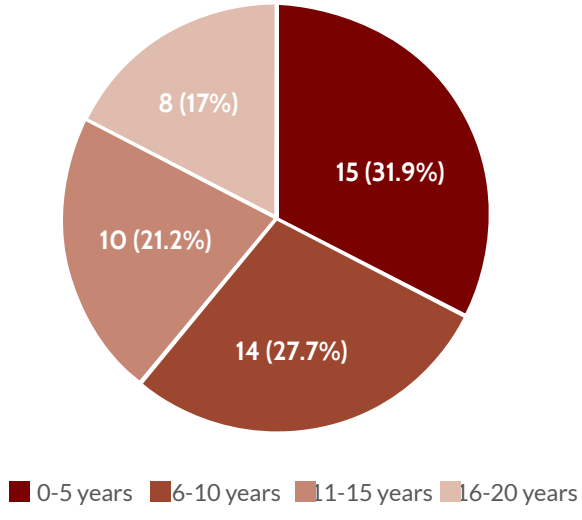


Figure 2. Pediatric Spinal Cord Injury Frequency by Gender. Source: CRIT State of Mexico 2008-2017

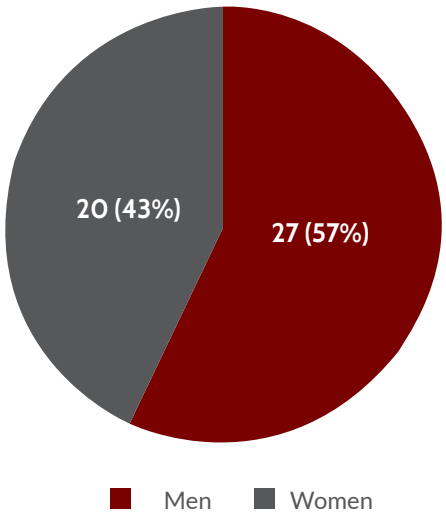


Table 1. Pediatric Spinal Cord Injury Frequency by Non-Traumatic Etiology
Source: CRIT State of Mexico 2008-2017.

Non-Traumatic Cause	No. Patients (%)
Tumor (Retroperitoneal Neuroblastoma)	11 (35.4%)
Infectious (Transverse Myelitis, Amebiasis)	5 (16.1%)
Vascular (AVM, aneurysms, hematomas, ischemia)	5 (16.1%)
Neonatal Hypoxia	4 (12.9%)
Metastases from Lymphoblastic Leukemia	1 (3.2%)
Post-chemotherapy for Lymphoblastic Leukemia	1 (3.2%)
Narrow Cervical Canal Syndrome in Achondroplasia	1 (3.2%)
CNS malformation (Arnold Chiari Syndrome 1)	1 (3.2%)
CNS Demyelinating Disease (De Devic)	1 (3.2%)
Spine Surgery for Scoliosis	1 (3.2%)
Total	31 (100%)

Table 2. Pediatric Spinal Cord Injury Frequency by Traumatic Etiology.
Source: CRIT State of Mexico 2008-2017.

Traumatic Cause	No. Patients (%)
Car accident	6 (37.5%)
Falls from heights, stairs	5 (31.2%)
Gunshot	3 (18.7%)
Obstetric trauma	1 (6.2%)
Ran over by a car	1 (6.2%)
Total	16 (100%)

Figure 3. Pediatric Spinal Cord Injury Frequency by Clinical Presentation.
Source: CRIT State of Mexico 2008-2017.

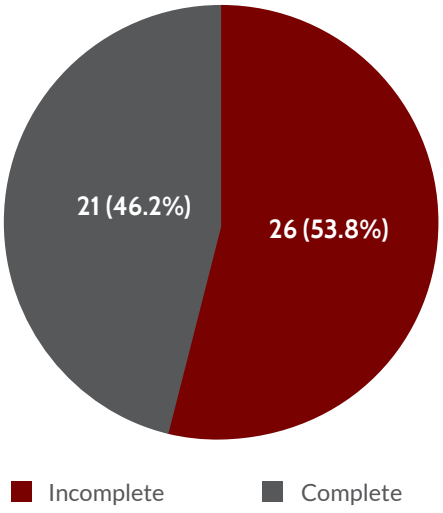
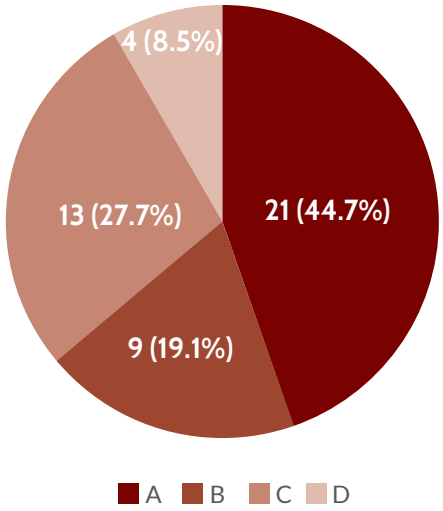


Table 3. Pediatric Spinal Cord Injury Frequency by Topography. Source: CRIT State of Mexico 2008-2017.

Topography	No. Patients (%)
Flaccid Paraplegia	15 (31.9%)
Spastic Paraparesis	9 (19.1%)
Spastic Paraplegia	8 (17%)
Spastic Quadriparesis	5 (10.6%)
Flaccid Paraparesis	4 (8.5%)
Mixed Quadriparesis	3 (6.3%)
Double Spastic Hemiparesis	1 (2.1%)
Spastic Diparesis	1 (2.1%)
Mixed Paraplegia	1 (2.1%)
Total	47 (100%)

Figure 4. Pediatric Spinal Cord Injury Frequency by ASIA Classification. Source: CRIT State of Mexico 2008-2017.



Conclusions

Spinal cord injury is rare in the pediatric age in the Mexican population that attends the CRIT, State of Mexico. The most frequent etiology in this study was nontraumatic, mainly of tumoral origin with a greater presentation in children under 10 years. Incomplete spinal cord injury was the most common at 53.8%. The most frequent topography was flaccid paraplegia, spastic paraplegia, and spastic paraparesis in 68%.

The highest percentage of cases (44.7%) was at level A of the ASIA classification.

It would be important to consider conducting a multi-center study to increase the population and obtain national figures that reflect the national behavior of this entity as a cause of motor disability in children under 18 years of age.

Conflicts of interest
We declare that this research has no conflicts of interest.

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