

ORIGINAL

Firearm injuries seen at a Pediatric Emergency Department in Uruguay

Lucía Erro^{1,2}, Mariana Más³, Soledad Tórtora^{2,3}, Diego Pereira Núñez^{4,5,6}, Javier Prego^{2,6,7,8}

¹Post-graduate in Pediatric Emergency Medicine, ³Assistant Professor of Pediatric Emergency Medicine, ⁴Associate Professor of Pediatric Surgery, ⁷Emeritus Professor of Pediatric Emergency Medicine. Medical School. Universidad de la República.

²Pediatrician - Pediatric Emergency Department, ⁵Pediatric Surgeon, ⁸Head of the Pediatric Emergency Department. Centro Hospitalario Pereira Rossell. Montevideo, Uruguay. ⁶State Health Services Administration

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Abstract

Firearm injury (FAI) is a growing concern in the pediatric population. In 1995, the first data on severe FAI in Uruguayan children were published, revealing a predominantly male distribution with a mean age of 14, and mostly occurring as unintentional incidents in the home. In 2012, a second case series identified a change in the profile of these injuries, now predominantly affecting male adolescents with a mean age of 13, occurring in violent circumstances outside the home. A considerable increase in FAI was observed at the same center.

Objectives: To describe the characteristics of FAI seen at the Pediatric Emergency Department (PED) of Centro Hospitalario Pereira Rossell (CHPR) over a 5-year period and to compare cases of severe FAI with data from a historical cohort seen at the same PED.

Methods: A descriptive, retrospective, cross-sectional study was conducted including patients < 15 years seen at PED-CHPR. Data source: Electronic medical records. We analyzed age, sex, circumstances surrounding the incident, location of injury, destination from PED, and severity.

Severe FAI was defined as requiring admission to intensive care or emergency surgery. Circumstances of the incident were categorized as intentional or unintentional (projectile not intentionally directed at the victim).

The research protocol was registered with the Ministry of Health and submitted to the Institutional Ethics Committee for approval. For statistical analysis EPIINFO 7 was used.

Results: 66 cases were included; 55 of whom were males. Mean age was 12 years. Overall, 38 cases occurred outside the home. Circumstances were intentional in 24, and unintentional in 21, weapon manipulation in 3, and unknown in 18. Of the cases, 40 were mild and 26 severe among a total 25,9974 visits to this PED.

Destinations after treatment at the PED were moderate care in 19, home in 21, intensive care or operating room in 25, and the morgue in 1. Two patients died.

Conclusions: The reported profile remained consistent, characterized by a predominance of underage male adolescents involved in violent situations outside the home. An increase in severe FAI is observed in this population.

Corresponding author:

Dra. Lucía Erro

E-mail: lucia.erro@gmail.com

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HERIDAS POR ARMA DE FUEGO ASISTIDAS EN UN DEPARTAMENTO DE EMERGENCIA PEDIÁTRICA EN URUGUAY

Resumen

Las heridas por arma de fuego (HAF) constituyen un problema en la población pediátrica. En 1995 se publicaron los primeros datos sobre HAF graves en niños uruguayos, presentándose mayoritariamente en varones, media 14 años, predominando mecanismo no intencional en domicilio.

En 2012, una segunda serie, observó cambio de perfil en las circunstancias de estas lesiones: adolescentes varones, media 13 años, contextos violentos, extradomicilio.

Se percibe un incremento de las HAF en el mismo centro.

Objetivos: Describir las características de consultas por HAF, durante un período de 5 años, Departamento de Emergencia Pediátrica (DEP), Centro Hospitalario Pereira Rossell (CHPR).

Comparar las HAF graves con datos previos del mismo DEP.

Metodología: Estudio descriptivo, retrospectivo. Población: < 15 años asistidos en DEP-CHPR. Fuente de datos: historia clínica electrónica. Variables: edad, sexo, circunstancias del evento, sitio de lesión, destino desde DEP, severidad.

HAF grave: ingreso a Cuidados Intensivos o Cirugía de Emergencia. Circunstancia del evento: intencional, no intencional (proyectil no dirigido voluntariamente a la víctima). Se registró el protocolo de investigación en el Ministerio de Salud. Se presentó al Comité de Ética de la Institución.

Análisis estadístico: programa EPIINFO 7.

Resultados y discusión: n= 66. Varones: 55/66. Media edad: 12 años. Extradomiciliario 38/66. Circunstancias: 24 intencional-violencia, 21 no intencional-violencia, 3 manipulación arma, 18 desconocida. Severidad: leves 40, severas 26. Hubo 26 HAF graves para un total de 259.974 consultas en este DEP. Destino: 19 cuidados moderados, 21 domicilio, 25 cuidados intensivos o quirófano, 1 morgue. Dos fallecidos.

Conclusiones: Se mantiene el perfil reportado previamente, predominando adolescentes varones, situaciones violentas, extradomicilio, menor edad.

Se evidencia aumento de las HAF graves en esta población.

INTRODUCTION

Firearm injuries (FAI) are currently an increasing problem in the pediatric population worldwide, and one of the leading causes of death in the pediatric population in the United States, ranking between the first and third cause⁽¹⁻⁵⁾. What was once considered an unusual and dramatic event is now a situation that pediatricians face relatively frequently at the pediatric emergency department (PED).

In recent years, there has been a steady increase in the number of FAI occurring in violent circumstances. The greater and easier access to weapons for adults, children and adolescents, inadequate control of arms possession by authorities, smuggling, criminal activities, addictions, the need for security and the growing violence in society are factors that are described as contributing to these injuries⁽¹⁻¹⁰⁾.

FAI pose a burden on healthcare systems and cause morbidity and mortality at all ages. In 2010 in the United States, it was estimated that the total cost (medical costs and decreased productivity) of all FAI in children under 18 years of age exceeded \$3.6 billion. The hidden costs of FAI are reflected in the fear and worry that is experienced in suburban neighborhoods where the majority of the population lives below the poverty line. The serious

consequences of these events range from death to both functional and psychological consequences, not only for the victims themselves, but also for those who witness these acts of violence.

In the United States, firearm injuries are observed to be more common in violent contexts in schoolchildren and adolescents of African and American descent in suburban neighborhoods of low socioeconomic levels⁽²⁻⁴⁾. Non-fatal injuries are twice as common as fatal injuries. Most injuries and deaths occur in violent circumstances⁽⁵⁾.

Regarding unintentional cases, although they are less frequent than intentional ones, the vast majority involve young children at home who are shot by a family member carrying a weapon or by another minor during play⁽²⁾. The true impact of unintentional FAI is unknown and difficult to characterize due to underreporting⁽²⁾.

Prevention strategies are essential to reduce the impact of FAI on the population. Gun ownership in the home is associated with increased risk of homicide, suicide, and unintentional injuries^(1,3-7).

In Uruguay, according to the latest data published by the National Arms Registry - Arms and Weapons Service (RNA-SMA), there is one weapon for every six Uruguayan citizens, of which 89% are owned by civilians⁽¹¹⁾.

Access to firearms increases the risk of peer violence and the risk of suicide. Nearly half of the suicides in males aged 14-19 years and 20% of suicides in females of the same age are associated with firearms^(1,4).

Pediatricians have the opportunity to get involved in this issue through primary prevention by discouraging the presence of weapons in the home and identifying groups exposed to violent situations where individuals may be injured, either voluntarily or involuntarily^(1,3-5,8).

Secondary prevention and timely and appropriate treatment once an injury has occurred are part of the necessary skills of every physician caring for children in the PED^(4,12).

The first data on severe FAI in Uruguayan children were published in 1995, in a study conducted at the (PED) of the Centro Hospitalario Pereira Rossell (CHPR), Montevideo, Uruguay, a third level pediatric hospital. At that time, FAI occurred more frequently in males, with a mean age of 14 years, and mostly as unintentional incidents at the home⁽¹³⁾.

In 2012, a second series was studied at the same center, recording a frequency of one severe FAI every 18,567 consultations. The profile of the adolescent male was maintained, with a decrease in the mean age (13 years) and a change in the setting, as most of them occurred in violent circumstances outside the home⁽⁹⁾.

In recent months, a sustained increase in FAI has been observed in society and healthcare centers across the country. Ten years after the last publication, an update study on these injuries was conducted at the same PED.

PRIMARY OBJECTIVE

To describe the characteristics of consultations for FAI at the DEP-CHPR in Montevideo, Uruguay between 2016 and 2020.

SECONDARY OBJECTIVE

To compare severe FAI cases with data from a historical cohort seen at the same PED.

MATERIALS AND METHODS

A descriptive, retrospective study was conducted. Patients under 15 years of age who were seen at the PED-CHPR for FAI between January 1, 2016, and December 31, 2020, were included. Electronic medical records were reviewed.

The following variables were included: age (quantitative), sex, circumstances surrounding the incident, location of injury, patient destination from the PED, and severity (qualitative).

Severe FHA was defined as those requiring admission to intensive care or emergency surgery.

Circumstances surrounding the incident were categorized as intentional (aggression by third parties) or unintentional (projectile not intentionally directed at the victim, individual located in the line of fire), without a context of intentional injury (self-harm), and without a context of unintentional injury

TABLE 1. Population characteristics and incident circumstances. DEP-CHPR 1/1/2016 - 31/12/2020.

Variable	Category	AF (n= 66)	RF
Sex	Male	55	83%
	Female	11	17%
Age	Mean	12 years	
	Median	13 years	
	Range	1-14 years	
Setting	Home	17	26%
	Outside the home	38	57.4%
	Unknown	11	16.6%
Circumstances	Intentional injury	23	35%
	Unintentional injury	21	32%
	Intentional self-harm	1	1.5%
	Unintentional non-violent	3	4.5%
	Unknown	18	27%

(unintentional firearm manipulation). Continuous variables are described as mean, median, and ranges, and discrete variables as absolute and relative frequencies. The chi-square test was used for the comparison of proportions. A $p < 0.05$ was considered statistically significant.

The presentation "10 years of severe firearm injuries" (period: 2002-2011) was considered for comparison⁽⁷⁾.

The research protocol was registered with the Ministry of Health and submitted to the Institutional Ethics Committee for approval. EPIINFO 7 statistical software was used for data processing and statistical analysis.

RESULTS

A total of 66 patients with FAI were included, and their demographic characteristics are presented in Table 1. The overall mean age was 12 years, with a median of 13 years (range 1 to 14). The mean age of children with intentional FAI was 13 years, while the mean age of children with unintentional FAI was 11 years. The details of the lesions are provided in Table 2.

In 41 patients (66%), the initial care was provided at a primary care center. The following location of severe FAI was observed: upper-lower limb vascular bundles in 5 (19%), thorax in 4 (15%), abdomen in 5 (19%), head and neck in 8 (31%), fractures in 3 (11%), and skin and soft tissues (pelvis) in 1 (4%). The incidence rate of severe FAI during this period ($n = 26$) was 1 in 10,000 consultations.

Two deaths were recorded: one due to thoracic injury with subsequent hemorrhagic shock in the PED and the second due to severe head injury resulting in death in the operating room. Severe FAI in this period was compared with that of the period 2002-2011. The results are presented in Table 3.

DISCUSSION

FAI have become a serious health concern in children. In our study, changes were observed compared to previous studies, showing an increase in severe FAI compared to

TABLE 2. Injury characteristics. DEP-CHPR 1/1/2016 – 31/12/2020.

Variable	Category	AF	RF
Location	Limbs	39	59%
	Head and neck	13	20%
	Thorax	7	11%
	Abdomen	3	4,5%
	Pelvis	1	1,5%
	More than one location	3	4,5%
Severity	Mild	40	61%
	Severe	26	39%
Destination (on PED discharge)	Intensive care/surgery room	25	38%
	Home	21	32%
	Intermediate care	19	29%
	Morgue	1	1,5%
Final outcome	Discharge from hospital	64	97%
	Death	2	3%

the previous study, from 1/18,567 to 1/10,000 visits ($p < 0.01$) in the same PED. A breakdown of the 2002-2011 period already showed this trend, with a frequency at the beginning of the period of 1/19,643 visits and at the end of the period of 1/12,250 visits. This finding is consistent with that reported worldwide^(1-5,8,9).

Similar to findings by other national and international studies, these lesions were more common in male adolescents^(1,3,8-10,13). The present study shows a sustained decrease in the mean age of the population, based on the findings of previous studies in the same PED^(9,13). It was observed that patients who suffered unintentional injuries were younger than those who suffered intentional injuries, coinciding with the findings of other studies^(1,2,5,8).

The 1995 report found that FAI occurred within the home, mostly linked to the possession of weapons in the home and in unintentional circumstances⁽¹³⁾.

The second series documented changes in the circumstances and locations of events. The most common scenario

differed, with an increase in FAI occurring in violent situations outside the home, accounting for 43%, while unintentional incidents accounted for 21% of cases⁽⁹⁾. In the present study, a statistically significant increase in violent incidents was observed, reaching 68.5% ($p < 0.02$), while non-violent incidents decreased to 4.5% ($p < 0.03$). This phenomenon is observed globally and may be attributed to various socio-cultural and economic factors, including the worldwide production and trade of arms, inadequate control of arms possession by authorities, smuggling, criminal activities, and a sense of security associated with firearm ownership, among others⁽²⁻⁷⁾.

Although less frequent, when comparing FAI with other injuries, the former are often more severe with a higher rate of hospital admissions⁽²⁾. In our study, more than one third of the FAI were severe, resulting in death in 2 patients. Two-thirds of the patients required hospital admission, with the majority being admitted to intensive care. In the United States, although FAI constitutes a small proportion of the total reasons for emergency department visits, the death rate is higher among children under 15 years compared to other industrialized countries^(3,5,14).

Regarding the location of severe FAI, injury to the head, neck, thorax, and abdomen predominated in previous studies and international publications^(9,10). Nevertheless, in our series, severe lesions in the limbs were the most common, accounting for 31% ($p < 0.03$).

Previous data on initial prehospital care were lacking. In the present study, 41 of the 66 patients received their first care at peripheral centers. While this allows for initial stabilization, the available resources, infrastructure, and limited human resources make it unfeasible to aim for definitive treatment. In many cases, the goal should be limited to initial stabilization, injury control, and timely transfer under favorable conditions. Pre-hospital care and transfer should take into account the need for blood transfusion and early surgical treatment, resources that are unavailable in peripheral care centers in Uruguay. International guidelines for the initial care of patients with FAI recommend rapid transfer of these patients to a tertiary care center.

TABLE 3. Characteristics of severe FAI. DEP-CHPR 1/1/2016 – 31/12/2020.

Variable	Category	2002-2011 (n= 34)	2016-2020 (n= 26)	P
Age	Mean	13 years	12 years	NS
Sex	Male	73%	83%	0.30
	Female	27%	17%	
Frequency		34/631244 visits (1/18,567)	26/241984 visits (1/10,000)	0.01
Setting	Home	30%	26%	0.41
	Extra-domicile	70%	57,4%	
Circumstance	Violent	43%	68.5%	0.02
	Non-intentional/non-violent	21%	4.5%	0.03
	Unknown	36%	27%	0.34
Injury location	Head/neck	21 (50%)	8 (31%)	0.01
	Thorax/abdomen	17 (40%)	9 (34%)	0.06
	Limbs	4 (10%)	8 (31%)	0.03
	Pelvis	0	1 (4%)	
Deaths		4	2	0.32

The weakness of this study is that it is a retrospective study, conducted at a single center; however, the DEP-CHPR is a national public pediatric referral center.

CONCLUSIONS

There is evidence of a sustained increase in severe FAI in the population assisted at the DEP-CHPR. The predominant profile continues to be male adolescents, with an increase in violent incidents outside the home. The age of the victims continues to decrease.

Despite the aforementioned weaknesses in this study, it is important to note that the DEP-CHPR is a national public pediatric referral center, making our findings a valuable contribution to the understanding of this type of injuries.

Primary and secondary prevention strategies should take into account these aspects to enhance the impact on this growing health issue.

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