

Perfil epidemiológico do trauma maxilofacial pediátrico: estudo retrospectivo de 20 anos de pacientes atendidos por serviço de pós-graduação universitária de Araçatuba, Brasil

Epidemiological profile of pediatric maxillofacial trauma: a 20-year retrospective study of patients treated by a university graduate service in Araçatuba, Brazil

Perfil epidemiológico del trauma maxilofacial pediátrico: un estudio retrospectivo de 20 años de pacientes tratados por un servicio universitario de posgrado en Araçatuba, Brasil

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Resumo

O objetivo deste estudo é apresentar uma análise retrospectiva de 20 anos dos casos de pacientes pediátricos acometidos por traumas faciais, atendidos pela equipe de Cirurgia e Traumatologia Bucomaxilofacial da Faculdade de Odontologia de Araçatuba UNESP, Brazil, e mostrar a incidência desses tipos de trauma, assim como fatores etiológicos mais comuns, idade e sexo de pacientes pediátricos que sofreram algum tipo de fratura e mostrar como as características sociais e culturais da população alteram diretamente a epidemiologia dessas moléstias em determinada região. Para tanto, foi realizado levantamento retrospectivo nos registros médicos de pacientes com até 12 anos de idade, de acordo com os critérios de elegibilidade adotados pelo estudo, em um período de 20 anos. O teste do qui-quadrado foi utilizado para comparar os grupos e a correlação de Pearson para verificar a associação entre as variáveis. Dos 312 prontuários analisados, as fraturas faciais foram registradas em 263 (84%), evidenciando uma alta incidência de fraturas na população estudada, sendo que a maioria delas ocorreu no sexo masculino e a principal fonte de trauma foi relacionada a eventos de alto impacto, como acidentes de trânsito, que causaram a prevalência de fraturas no terço médio da face. Dessa forma, é possível concluir que a morbimortalidade infantil por trauma maxilofacial foi alta em nosso estudo, mas vale ressaltar que esses números podem ser reduzidos com medidas de educação e segurança no trânsito, tanto para crianças quanto para adultos, os verdadeiros responsáveis por essa casuística.

Palavras-chave: Pediatria; Traumatologia; Epidemiologia.

Abstract

The objective of this study is to present a 20-year retrospective analysis of cases of pediatric patients affected by facial trauma, attended by the team of Oral and Maxillofacial Surgery and Traumatology of the School of Dentistry of Araçatuba (UNESP), Brazil, and to show the incidence of these types of trauma, as well as the most common etiological factors, age and sex of pediatric patients who suffered some type of fracture and show how the social and cultural characteristics of the population directly alter the epidemiology of these diseases in a given region. For this purpose, a retrospective survey was carried out on the medical records of patients up to 12 years of age, according to the eligibility criteria adopted by the study, over a period of 20 years. The chi-square test was used to compare groups and Pearson's correlation to verify the association between variables. Of the 312 medical records analyzed,

facial fractures were recorded in 263 (84%), which shows a high incidence of fractures in the study population, the majority of which occurred in males and the main source of trauma was related to high impact, such as traffic accidents, which caused the prevalence of fractures in the middle third of the face. Thus, it is possible to conclude that child morbidity and mortality due to maxillofacial trauma was high in our study, but it is worth mentioning that these numbers can be reduced with education and traffic safety measures, both for children and adults, who are truly responsible for this series.

Keywords: Pediatrics; Traumatology; Epidemiology.

Resumen

El objetivo de este estudio es presentar un análisis retrospectivo de 20 años de casos de pacientes pediátricos afectados por trauma facial, atendido por el equipo de Cirugía Oral y Maxilofacial y Traumatología de la Facultad de Odontología de Araçatuba (UNESP), Brasil, y mostrar la incidencia de este tipo de trauma, así como los factores etiológicos más comunes, la edad y el sexo de los pacientes pediátricos que sufrieron algún tipo de fractura y muestran cómo las características sociales y culturales de la población alteran directamente la epidemiología de estas enfermedades en una región determinada. Para este propósito, se realizó una encuesta retrospectiva sobre los registros médicos de pacientes de hasta 12 años de edad, de acuerdo con los criterios de elegibilidad adoptados por el estudio, durante un período de 20 años. La prueba de chi-cuadrado se utilizó para comparar grupos y la correlación de Pearson para verificar la asociación entre variables. De los 312 registros médicos analizados, las fracturas faciales se registraron en 263 (84%), lo que muestra una alta incidencia de fracturas en la población de estudio, la mayoría de las cuales ocurrieron en hombres y la principal fuente de trauma se relacionó con impacto, como los accidentes de tránsito, que causaron la prevalencia de fracturas en el tercio medio de la cara. Por lo tanto, es posible concluir que la morbilidad y mortalidad infantil debido a un trauma maxilofacial fue alta en nuestro estudio, pero vale la pena mencionar que estos números pueden reducirse con medidas de educación y seguridad vial, tanto para niños como para adultos, que son realmente responsables de esta serie.

Palabras clave: Pediatría; Traumatología; Epidemiología.

1. Introduction

Trauma is one of the main factors related to mortality in children (Kellman et al. 2014). When we compare children to adults, we find many anatomical and developmental differences that reflect different patterns (Allred et al. 2015).

Epidemiological results, on the other hand, show the preponderance of males among individuals with these complications. Etiologic factors, as well as fractured facial structures, are much more varied (Qing-bin et al. 2013; Ferreira et al. 2015; Ferreira et al. 2015). Long-term follow-up with a multidisciplinary team is important to manage changes in facial development that may affect these lesions (Boyette et al. 2014).

In this context, the city of Araçatuba, located in the interior of the State of São Paulo, Brazil, has presented, over the years, a significant number of high impact traumas, especially caused by traffic accidents, in addition to the high occurrence of interpersonal aggressions. Facial traumas, in turn, occupy an important part of these cases, having become the object of studies for a better understanding of the causes of traumas and how local factors can change the way they occur (Faverani et al. 2008; Minari et al. 2020).

Thus, the objective of this study is to present a 20-year retrospective analysis of cases of pediatric patients affected by facial trauma, treated by the Buccomaxillofacial Surgery and Traumatology team at the School of Dentistry of Araçatuba, Brazil, and to show the incidence of these types of trauma, as well as the most common etiological factors, age and sex of pediatric patients who suffered some type of fracture and show how the social and cultural characteristics of the population directly alter the epidemiology of these diseases in a given region.

2. Methodology

This study was carried out at São Paulo State University (UNESP), School of Dentistry, in the city of Araçatuba, Brazil and was approved by the Human Ethics Committee, under protocol number 2006-32.

Based on the theoretical basis of the methodology used in recently published research (Minari et al. 2020), this study consists of a retrospective assessment, carried out based on a qualitative and quantitative exploratory analysis of medical records of pediatric patients, from 0 to 12 years old treated, between the years 1998 and 2018, by the postgraduate team in Buccomaxillofacial Surgery and Traumatology of the Department of Diagnosis and Surgery

of the School of Dentistry of Araçatuba, Brazil.

For inclusion in the study, the medical records selected met the following inclusion criteria:

- Patients under 12 years old at the time of the trauma;
- Complete records containing: anamnesis, information about the etiological factor, type and location of the fracture, in addition to attached image exams.

The entire database was scanned and tabulated using Microsoft Excel® (Epiinfo) and information corresponding to age, sex, etiological factors, types of facial injuries and types of bone fractures were digitized and tabulated. The statistical analysis of the data was performed using the SPSS Statistics software (version 20.0) and the chi square test was used to compare groups and Pearson's correlation to verify associations between variables. After being collected, this information was organized and inserted in tables for better comparison and presentation of data.

3. Results and Discussion

There were an initially 5,506 records available for research. Of these, 312 (12%) fit within the inclusion criteria. Fracture occurrence was analyzed in relation to the age of the patients. Six-year-olds had the highest number of fractures, with a total of 32 cases (12.2%) (Table 1).

Of the 312 patients analyzed, 263 (84.2%) suffered some type of facial fracture. Of those, 169 (64.3%) were male, and 94 (35.7%) were female.

Table 1. The relationship between age and the number of facial fractures.

Age years	Presence of Facial Fracture	
	N	%
0	1	0.4
1	11	4.2
2	24	9.1
3	23	8.7
4	22	8.4
5	26	9.9
6	32	12.2
7	26	9.9
8	22	8.4
9	12	4.6
10	24	9.1
11	15	5.7
12	25	9.5
TOTAL	263	100

Source: Prepared by the authors with the research data.

In general, motorcycles were the main cause of accidents, and were involved in 58 cases (18.6% of the total). Bicycles were the second major cause, with 51 cases (16.3%). The highest number of bicycle accidents occurred in the 6-10 age group ($p=0.005$). The increase in the number of accidents was directly proportional to an increase in age ($p=0.047$).

Only one case of trauma (0.4%) occurred in an infant younger than 1 year of age; this case was caused by physical aggression from an adult. Physical aggression was the cause in 42 cases (13.5%), making it the third major cause of maxillofacial fractures. Of these, 8 cases (24.2%) occurred in 5-year-olds.

The total number of fractures ($N=344$) is greater than the number of patients ($N=263$), because in some cases the patient suffered more than one fracture in different locations. Of the patients treated for multiple fractures, 7.5% were male, while 8% were female.

When we isolated and analyzed the etiological factors affecting each gender, we observed different situations. The greatest cause of fracture in males was motorcycle accidents (23.6%). However, falls were the cause of 18.5% of facial fractures in this genus (Table 2).

The only etiology for which there was a greater number of female victims was physical aggression, but the difference was small. There were 21 cases of aggression involving females (24.0% of the total), while there were 18 cases (12.9% of the total) involving males. This difference was significant ($p=0.01$). Motorcycles accidents were responsible for 18.2% of the recorded cases involving females, which makes it the second major etiological factor for this gender (Table 2).

Of all the etiological factors reported, almost all were more frequent in males (Table 2). There was also a positive correlation between the number of cases caused by each etiological factor and the gender.

Table 2. Number of cases and the respective etiological factors by gender

	Male		Female		TOTAL	
	N	%	N	%	N	%
Automobiles	19	13.6	14	15.9	33	14.5
Accidents with animals	10	7.1	6	6.8	16	7.0
Bicycles	20	14.3	15	17.0	35	15.4
Sports	6	4.3	3	3.4	9	3.9
Motorcycles	33	23.6	16	18.2	49	21.5
Physical aggression	18	12.9	21	24.0	39	17.1
Hit and run	3	2.1	0	0.0	3	1.3
Injury by firearm	5	3.6	1	1.1	6	2.6
Fall from own height	26	18.5	12	13.6	38	16.7
TOTAL	140	100.0	88	100.0	228	100.0

Source: Prepared by the authors with the research data.

The three facial zones were analyzed, but we were mostly concerned with the middle and mandibular thirds, since they are areas of interest for bucomaxillofacial surgeons.

The upper third of the face presented only 6 cases. The middle third was the most

affected area, with 204 cases. Fractures of the zygomatic complex were mainly responsible for this number, totaling 97 cases (30.4% of the total). Fracture without displacement of the nasal bone also occupied a prominent place in the survey, accounting for 59 (18.5%) cases. However, displacement of this same bone structure occurred in 22 cases (6.9%). These were the most expressive numbers observed for the middle third of the face (Table 3).

Of all fractures, 134 reached the mandibular complex. Fracture of the jaw body was the cause of damage in 35 children (11.0%). The jaw symphysis region was also affected in 30 cases (9.4%).

A comparison was made between the gender and type of fracture. Results showed that the most frequent fracture occurred in the zygomatic complex, with 67 occurrences in males and 30 in females (Table 3).

Table 3. Number of cases and the respective fracture type by gender.

Fracture type	Male		Female		TOTAL	
	N	%	N	%	N	%
Facial contusion	2	1.0	0	0.0	2	0.6
Blunt wound	4	2.0	3	2.6	7	2.2
Lacerococontinuous injury	2	1.0	0	0.0	2	0.6
Frontal bone fracture	3	1.5	3	2.6	6	2.9
Zygomatic complex fracture	67	33.0	30	25.9	97	30.4
Nasal fracture with displacement	14	6.9	8	6.9	22	6.9
Comminuted nasal fracture	0	0.0	1	0.9	1	0.3
Nasal fracture without displacement	39	19.2	20	17.2	59	18.5
Fracture naso-orbiting-ethmoid	2	1.0	3	2.6	5	1.6
Fracture of orbit	1	0.5	0	0.0	1	0.3
Le Fort I fracture	3	1.5	0	0.0	3	0.9
Le Fort II fracture	6	3.0	2	1.7	8	2.5
Le Fort III fracture	1	0.5	3	2.6	4	1.3
Maxillary fracture	3	1.5	0	0.0	3	0.9
Fracture of the jaw symphysis	21	10.3	9	7.8	30	9.4
Condyle mandibular fracture	17	8.4	11	9.5	28	8.8
Coronoid process fracture	0	0.0	3	2.6	3	0.9
Body fracture	17	8.4	18	15.5	35	11.0
Branch fracture	1	0.5	2	1.7	3	0.9

Source: Prepared by the authors with the research data.

There are variations in the literature regarding the age limit of pediatric patients for epidemiological studies, which in some ways made it difficult to analyze other studies that could be used in a comparative analysis. In several studies, the maximum age of pediatric patients ranged from 11 to 18 years (Gassner et al. 2004; Imahara et al. 2008; Boffano et al. 2015).

Other articles evaluated the index of facial fractures in children together with patients in adulthood, without giving adequate attention to the particular aspects of this group (Silva et

al. 2011; Montovani et al. 2006). In the present study, however, we specifically chose the age limit of 12 years, because the Statute of the Child and Adolescent (ECA - n. 8.069/90 of July 13, 1990) considers a child to be a person between 12 and 18 years of age. In this way, we were able to standardize and direct our study to a specific group.

We first evaluated the relation between age and the number of fractures. Results verified that, at 6 years of age, a child is at greater risk of suffering a fracture (12.2% of the cases) than at other ages, and that, for some etiologies such as bicycle accidents, the number of cases increases with the age of the patients in the 6-10 age group. This is important because, starting in this age group, children become more active and have more social interaction; they tend to be more exposed to causative factors of trauma, thus increasing the incidence of fractures. Younger children, on the other hand, are generally more closely monitored by their caretakers, which reduces exposure to risk factors. This result, however, differs from that reported by Robert Gassner in 2004 (Gassner et al. 2004), who held that the 1-4 age group was the most affected (26.3%).

The prevalence of males in relation to females is evident. There were 169 cases (64.3%) involving males and 94 (35.7%) involving females. According to studies performed by Ferreira, et al. (Ferreira et al. 2015; Ferreira et al. 2015), there is a strong preponderance of males treated for injuries, even in the pediatric population. This is attributed mainly to the fact that the physical activity of males is generally more intense and dangerous than that of females. Such activities, as well as children's behavior, are major triggers for injuries, regardless of geographic location or season (Svider et al. 2016).

The most prevalent etiological factor in the present study was motorcycle accidents, which were involved in 58 cases (18.6% of the total). This result was somewhat predictable, given that the city of Araçatuba has a large number of accidents involving motorcycles. According to a study developed by Faverani, et al. (Faverani et al. 2008), in which 1.190 patients with facial fractures were analyzed, 189 (15.89%) were victims of motorcycle accidents in the city and in their region. The number of accidents caused by motorcycles has increased every year. According to a survey conducted by the Health Department of the State of São Paulo, 81 hospitalizations were registered in 2008 and 439 in 2011 – a 5-fold increase in a 4-year interval. However, the increase of motorcycle accidents involving children is a warning sign for everyone, as children may be being transported inappropriately or without the needed safety equipment.

Bicycle accidents followed as the second major factor in the present study. According to Muñante-Cárdenas (Muñante-Cárdenas et al. 2010), bicycle accidents are one of the most

common causes of mandibular fractures in children and adolescents, in addition to falling from their own height. However, in another study developed by Lima Júnior, (Lima SM Jr et al. 2011), bicycle accidents were most commonly associated with soft-tissue abrasions, hematomas, and dentoalveolar fractures. We believe this is due to the lower-impact force that occurs during an accident involving bicycles. The role of parents or guardians should be discussed, since the child is often incapable of attending to safety issues. In most cases, responsibility for a child's protection falls directly on the caretaker.

Falling from their own height was also a common etiology in the present study (38 cases, 16.7%). According to Souza (Souza et al. 2010), falls are one of the main causes of trauma among children, second only to traffic accidents.

The next etiological factor to be discussed is more than a public health problem. It is a social issue: physical aggression. There were 39 cases (17.1%) in which children were beaten. Curiously, of all the causes of fractures evaluated, this was the only one in which females were more affected than males. There were 21 cases involving females and 18 involving males, making the prevalence of the female gender statistically significant ($p=0.01$). Studies by Fonseca (Fonseca et al. 1992) on child victims of maltreatment showed that 38.8% were male and 61.2% were female. According to Zachariades et al. 1990, females are more susceptible to abuse because they are more defenseless, have greater physical fragility, are less able to escape from an aggressive adult, and have less authority and less-violent responses. Domestic trauma from aggression to children is not uncommon. Patients who present with multiple fractures are often carriers of the Beaten Child Syndrome (Kempe et al. 1962) once these fractures present in different stages of healing. Such a syndrome must be reported to authorities by the health professional.

In addition to the trend regarding gender and physical abuse, we observed a small prevalence of females when the occurrence of multiple facial fractures was analyzed (8.0% female, 7.5% male). We suggest that these values may be related to the fact that females suffered more from physical aggression, as multiple fractures are characteristic of victims of domestic violence.

To better evaluate the location and topography of fractures of the facial bone structures, we used anatomical borders to divide the face into three zones: upper third, middle third and lower third (mandible). In this way, the facial delimitations most affected could be better evidenced. The middle third was the most affected. Of the 344 fractures, 204 (59.3%) involved the middle third of the face. The most traumatized structure of this area was the zygomatic complex, with 97 recorded occurrences (48% of cases involving the middle third

and 30.4% of the total). Several articles have reported that there is a lower incidence of fractures in the middle third of the face in children because the injuries are caused by a higher impact trauma. However, its higher prevalence within our study may be directly related to the fact that the most common etiologic factors, such as traffic accidents, are of high impact. This result reflects the socio-educational conditions and the degree of instruction of drivers within the geographic limits studied.

Nasal bones can withstand intense trauma without fractures due to their elasticity. Even so, fractures of the nose are quite common in children (Costa et al. 1980). Nasal fracture without displacement was highlighted in the survey, with 59 cases (18.5%). However, displacement of this same bone structure occurred in 22 cases (6.9%). In a study conducted by Posnick (Posnick et al. 1993), 58% of nasal fractures caused minimal displacement and were treated conservatively, without the need for surgery.

Le Fort jaw fractures were recorded in a few cases. Le Fort I, Le Fort II and Le Fort III fractures were recorded in 0.9%, 2.5% and 1.3% of cases, respectively. These fractures tended not to follow the typical “Le Fort type” lines, because the craniofacial sutures of the patients were not yet closed. This causes significant differences in the incidence and distribution of the forces suffered at the moment of impact. Unlike adult bones, the tender and elastic bone structure at this stage of development can sustain considerable impact without compromising its integrity.

The mandible was also greatly affected. The mandibular structure suffered some type of trauma in 134 of the reported cases. It is important to highlight how this region may be subjected to trauma. According to Souza et al. 2010, involvement of the mandible occurs because it is in a vulnerable and projected position of the face and thus more susceptible to frontal impact. The jaw body was the most affected part, with 35 fractures (11.0% of the total). Symphysis fracture also reached significant numbers (30 cases, 9.4%), followed by condyle with 28 cases (8.8%). This distribution differs from that normally found in the literature. According to other studies, on mandibular fractures in children, the condyle is usually the most affected region, followed by the parassinphyseal region, the jaw body, and the angle area (Spring et al. 1996). Jaw fractures, especially condylar fractures, result in sequelae that must be treated as ankylosis, malocclusion and persistent pain.

4. Final Considerations

This study allowed us to conclude that there was a high incidence of facial fractures

caused by high impact trauma in the studied pediatric population, with the middle third of the face as the most affected. This infantile morbidity and mortality was high in our study, but it is worth mentioning that these numbers can be significantly reduced by means of education and traffic safety measures, for both children and adults, who are truly responsible for this series.

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Izabela Soares Minari – 12%

João Paulo Bonardi – 12%

Daniela Ponzoni – 14%

Daniela Atili Brandini – 20%

Ana Paula Farnezi Bassi – 30%