ARTIGO ORIGINAL
ISSN 1677-5090

Head and brain trauma among children and adolescents at a public hospital in Recife, Brazil

Traumatismo cranioencefálico entre crianças e adolescentes em um hospital público de Recife, Brasil

Silvana Orestes-Cardoso[1]; Adelmo Cavalcanti Aragao-Neto[2]; Antonio Jorge Orestes-Cardoso[3]; Jackson Santos Lôbo[4]; Josimário João Silva[5]; Alan Bruno Lira Farias[6]

[1]Associate Professor - Federal University of Pernambuco (UFPE) . PhD (Université de Paris VII, France; [2]Student of the Master's Program in Biochemistry and Physiology (UFPE); [3]Maxillofacial surgeon - Staff of Getúlio Vargas Hospital, MSc - Pernambuco University (UPE); [4]Professor - Federal University of Sergipe (UFS), PhD (UFPE); [5]Professor (UFPE), PhD - Federal University of Rio Grande do Sul (UFRGS); [6]Professor - Estadual Paraíba University (UEPB), MSc (UFPE)

Abstract
Introduction: *The Head and Brain Trauma (HBT) have a great potential to cause sequelae, therefore extremely important for the health professionals.* ***Objective:*** *The aim of this paper is to provide an epidemiological overview about HBT in a high complex health unit located in Recife, PE, Brazil.* ***Methodology:*** *Risk factors were divided in: Urban Violence (Road accidents, Running Over, Firearm, Physical aggression and Melee weapon) and Non-Urban Violence (Falls, Accidental Trauma, Sports and others). Statistical analysis was performed using descriptive and inferential techniques, such as: Fisher exact test, Chi-square test, and likelihood-ratio test. The statistical significance was set at 5%.* ***Results:*** *HBT was present in 5.5%, predominantly between ages ranging of 0 to 19 years old (17.6%). In this amount, the male gender had higher values than female, being the most affected the age ranging from 15 to 19 years, presenting a ration of 2.4:1. Concerning etiological factors, Non-urban-violence was present in 87.8%, occurring predominance in age ranging from 0 to 1 year old (96.2%).* ***Conclusion:*** *It was found prevalence of accidents among the male gender, which is a constant observed also in several other studies, however, a more alarming factor is the high rate of accidents involving young children, being indispensable the parents necessity of work, they received only essential care, being under the tutelage of older brothers, neighbors, and even non-nuclear relatives.*
Keywords: *Epidemiologia. Traumatismos Craniocerebrais. Prevenção de Acidentes.*

Resumo
Introdução: O trauma cranio-encefálico (TCE) é uma das emergências com maior potencial de causar sequelas, portanto, de extrema relevância para os profissionais de saúde. **Objetivo:** O presente estudo teve como finalidade delinear um panorama epidemiológico do TCE em unidade de alta complexidade localizada na cidade de Recife-PE, Brasil. **Metodologia:** Os fatores de risco foram divididos em: Violência urbana (acidentes viários, agressões com perda de consciência, projétil de arma de fogo, agressão por outros tipos de armas, e ataque físico) e Causas diversas (quedas, traumatismos acidentais, esportes e outros). A análise estatística utilizou técnicas descritivas e inferenciais: Teste exato de Fisher; Qui-quadrado; e razão de Verissimilhança. O nível de significância estatística foi de 5%. **Resultados:** O TCE esteve presente em 5,5%, cuja faixa etária mais acometida variou de 0 a 19 anos (17,6%). O sexo masculino obteve valores mais elevados do que o feminino, onde o ápice se deu dos 15 aos 19 (2.4:1). O fator Causas diversas esteve presente em 87.8%, ocorrendo predominantemente no grupo etário de 0 a 1 ano (96.2%). **Conclusão:** Acidentes envolvendo o sexo masculino foram prevalentes, o que é uma constante observada também em outros estudos, contudo, o mais alarmante é o índice de acidentes envolvendo crianças pequenas, que devido à necessidade de trabalho dos pais, recebem apenas cuidados essenciais, ficando sob a tutela dos irmãos mais velhos, vizinhos, e até mesmo parentes não nucleares.
Palavras-chave: Epidemiology. Craniocerebral Trauma. Accident Prevention.

INTRODUCTION

In the context of the present study, head and brain trauma (HBT) was defined as any type of damage that produces an anatomical injury or functional impairment, or both, involving cranial and encephalic bone structures [1], resulting from the ineffectiveness of preventive measures [2], as well as from unsatisfactory urban, economic and social living conditions [3].

In Brazil, the official information on mortality does not make it possible to obtain the proportion of HBTs in the deceased population. It is estimated, however, that the minimum and maximum rates of mortality from HBT are 26.2 and 39.3, respectively, per 100,000 inhabitants for road accidents alone [4]. As a result, trauma represents an institutional challenge as yet without solution, due both to the high mortality rates and to the possibility of morphofunctional sequelae, involving substantial expenses with rehabilitation and demanding multidisciplinary studies [5].

Knowledge of the etiological factors is of fundamental importance in establishing measures for

Correspondência / Correspondence: Silvana Orestes-Cardoso
Rua Djalma Farias, 29 – Torrão – CEP: 52030-190 – RECIFE, PE, BRASIL
E-mail: silvanaorestes@hotmail.com Celular: (81) 96125516

preventing trauma, whose causes are multifactorial, frequently varying according to age, gender, ethnic group and geographical region [6]. In the cities of Latin America, injuries caused by accidents and violence have shown an alarming increase, whether as a result of criminality or of accidents due to violent practices in sport, inappropriate leisure activities or the lack of decent living conditions or safety precautions at work and in traffic[3].

Specific epidemiological studies on HBT are few in number and difficult to conduct [4] which makes it impossible to accurately determine the number of individuals affected by HBT every year. Nonetheless, we consider it important to present the possible means of analyzing the traumas resulting from external causes, using the databases available at Recife, Brazil, where rates of morbidity and mortality from accidental and intentional injury are high and HBT is a common lesion [7]. Statistical retrospective studies of this nature have the purpose of revealing the current state of affairs in order that preventive measures can be adopted and suitable actions planned to face the problem, also enabling certain sociodemographic features to be compared with those from other studies elsewhere.

The vulnerability of children to head injuries in general is naturally increased by some anatomical and developmental aspects. The young brain is enclosed in a thin and pliable skull, with non-ossified bones, unfused sutures and open fontanelles. The weight of the newborn child's head is about 10–15% of its body weight compared to 2–3% for the adult head. The young child's neck musculature is immature and unable to fully support the weight of the head. The large brain of the young child has a relatively large subarachnoid space which is also very shallow in depth with the brain closely positioned next to the skull [8]. The exposure of adolescents to head injuries, on the other hand, occurs more frequently due to participation in road accidents involving motor vehicles or intense sports activity, in a period characterized by growth, freedom and adjustment in all aspects of life [9].

The literature emphasizes that head injury in the youngest age group (24 months or younger) is distinct from that occurring in older children or adults because of differences in mechanisms, injury thresholds, and the frequency with which the question of child abuse is encountered. A prospective study with 100 patients in that age group showed 24% of injuries were presumed inflicted, and an additional 32% were suspicious for abuse, neglect, or social or family problems [10].

Thus, the present study had the objective of verifying the occurrence of HBT among patients with craniofacial trauma (CFT) admitted to one of the largest public hospital dealing with trauma in the north and northeast of Brazil, emphasizing the involvement of children and adolescents by this kind of lesion.

MATERIALS AND METHODS

The city of Recife, the state capital of Pernambuco, is a major metropolis, located in the Northeast Region of Brazil. Hospital da Restauração (HR) is a general public hospital considered to be a reference center for traumatized patients at the metropolitan region of Recife, predominantly those of a low socioeconomic level, who benefit from the public health system services (SistemaÚnico de Saúde - SUS).

After approval of this study by HR's Research Ethics Committee, the sociodemographic and clinical data of interest were collected through direct analysis of the records of the Department of Medical Archives and Statistics (Serviço de ArquivosMédicos e Estatística – SAME), ranging from May 2008 to May 2011, and transferred to index cards by a single researcher so as to avoid different interpretations. However, in order to preserve the reliability of the data, everything recorded on the index cards was reviewed by one of the other authors. The original clinical records that were unintelligible, those with more than two variables missing and those not falling into the specified category were excluded from the sample.

According to external causes, the HBT were divided as follows: Urban violence (Road accidents, Running over, Firearm, Physical aggression, Melee Weapon) and Non-Urban violence (Accidental trauma from a fall, accident at work, sports and not identified/ other causes).

Regarding statistical analysis, techniques of descriptive and inferential statistics where used. The Fisher exact test was applied when the conditions for using the chi-square test were not verified, and the likelihood-ratio test used when was not possible to obtain results through the Fisher exact test. The level of Statistical Significance used in the tests was 5.0% and the confidence interval was 95.0%. The date entered on the Microsoft Excel spreadsheet and the program used to carry out the statistical calculations was SPSS (Statistical Package for the Social Sciences) version 15.

RESULTS

Characterization of the patients

During the period of the study a total of 11.198 clinical records with CFT were selected. The distributions of the participants according to age group is seen at Table 1, where is shown that the percentage of HBT within the CFT patients was higher among the patients aged 0-19 years (17.6%), with an statistically significant difference from the other age groups (test of comparisons of proportions), where the analogous percentages were 1.6% (20-64 years) and 2.2% (65 years or more).

Table 1 shows that prevalence of HBT was 5.5% in the total sample. However, analyzing by different ages we found that the highest prevalence corresponded to the range between 0 and 19 (17.6%) and the smallest one ranging from 65 (2.8%).

The distribution of children and adolescents in age subgroups and according to sex is seen at Table 2. The mean age was 5.2 years and standard deviation of 4.45 years.

Table 2 shows that female cases percentage was slightly bigger than half of the total (52.8%) in age range under one year, however in other age groups surveyed,

Table 1. *Frequency of cases of craniofacial trauma (CFT) and head and brain traumatism (HBT) at each age group.*

	CASES OF CFT		CASES OF HBT		
Age group (in years)	**(N)**	**(%)**	**(N)**	**(%) among the cases of HBT**	**Prevalenceof HBT (CI 95%)**
0 – 19	2693	24.1%	474	76.8%	17,6% (16,2 – 19,0)
20 – 64	7738	69.2%	126	20.4%	1,6% (1,4 – 1,9)
65 or more	753	6.7%	17	2.8%	2,2% (1,2 – 3,3)
TOTAL	**11,184[(1)]**	**100**	**617[(2)]**	**100.0**	**5,5% (CI 95%: 5.1-5.9)**

(1) It was not possible to identify the age of 14 of the patients studied.
CI – Confidence Interval.

Table 2*. Gender distribution of 0-19 year-old patients, according to age subgroups.*

Age subgroup		Male	Female	Total	p
<1 year	N	25	28	53	p = 0.037*[(1)]
	%	47.2%	52.8%	100.0%	
1-4 years	N	118	79	197	
	%	59.9%	40.1%	100.0%	
5-9 years	N	97	54	151	
	%	64.2%	35.8%	100.0%	
10-14 years	N	37	12	49	
	%	75.5%	24.5%	100.0%	
15-19 years	N	17	7	24	
	%	70.8%	29.2%	100.0%	
Total	N	294	180	474	
	%	62.0%	38.0%	100.0%	

(*) Significance Level at 5.0%.
(1) Chi-square Test

the percentage of HBT cases was higher in male gender and grow bigger accordingly age until the age group ranging from 10 to 14 years and decreased from 75.5% to 70.8% in comparison with age ranging from 15 to 19 years. Proving significant association between age range and gender (p<0.05).

The proportion male:female was approximately 1:1 in the subgroup with less than one year-old, with percentages of 47.2% e 52.8%, respectively. As older age groups are analyzed, an increase of the male percentage is noticed, reaching a proportion of approximately 2.4:1 among the 15-19 year-old patients (70.8% males, 29.2% females)(Table 2).

Analysis of The Etiological Factors Associated with HBT

Table 3 shows the distribution of the etiological factors of HBT by gender and age among the 0-19 year-old patients. The table highlights the fact that the non urban violence causes, especially the fall, are the major responsible for the HBTs, present in 87.8% of the cases, reaching a percentage of 96.2% in the age subgroup of less than one year. This percentage decreases with the increase of the age, being replaced by urban violence, which was associated with 66.7% of the HBTs among the 15-19 year-old patients. Analyzing the 0-19 year-old group, 12.2% of the HBTs were associated with urban

Table 3. Distribution of participants according to gender, age and etiological factor.

	Urban Violence					Non-Urban Violence (1)		
	Road Accident	Running Over	Firearm	Physical Aggression	Melee Weapon		Total	p(**)
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
Gender								
Male	25 (8.5%)	6 (2.0%)	1 (0.3%)	5 (1.7%)	1 (0.3%)	256 (87.1%)	294 (100%)	p (1) = 0,816
Female	11 (6.1%)	6 (3.3%)	-	3 (1.7%)	-	160 (88.9%)	180 (100%)	
Age								
< 1 year	-	1 (1.9%)	-	1 (1.9%)	-	51 (96.2%)	53 (100%)	p (2)< 0,001*
1-4 years	9 (4.6%)	2 (1.0%)	-	-	-	186 (94.4%)	197 (100%)	
5-9 years	14 (9.3%)	5 (3.3%)	-	-	-	132 (87.4%)	151 (100%)	
10-14 years	5 (10.2%)	3 (6.1%)	-	2 (4.1%)	-	39 (79.6%)	49 (100%)	
15-19 years	8 (33.3%)	1 (4.2%)	1 (4.2%)	5 (20.8%)	1 (4.2%)	8 (33.3%)	24 (100%)	
Total	**36 (7.6%)**	**12 (2.5%)**	**1 (0.2%)**	**8 (1.7%)**	**1 (0.2%)**	**416 (87.8%)**	**474 (100%)**	

(*) The majority of cases (411/416) of not urban violence were falls. The other 5 had not identified causes.
(**) Significance Level at 5.0%
(1) Fisher exact Test
(2)Likelihood-ratio Test.

violence events, among which the road accidents (7.6%) stand out (Table 3).

Regarding Table 3, excepting age group from 15 to 19 years in all other groups the majority of HBT cases in each gender where Non-Urban Violence. In age group from 15 to 19 exactly 1/3 of 24 cases where Road Accident and 1/3 where Non-Urban Violence. So we found a significant association between age and etiological factor (p>0.05).

DISCUSSION

Currently, trauma is one of the main public health problem faced by children and represents the major cause of morbidity and mortality in this age group [11,12]. Over the past three decades, studies have demonstrated that the main etiological factors in younger children of both sexes have been falls from height and on same level, due to the motility learning process, as they lack the ability to identify danger in the environment and are impulsive and unable to reflect on their own actions. Even though, a study demonstrated that while different fall heights were associated with different injury types, most household falls were neurologically benign [10)].

In our study, within the age group up to 19 years-old, 84.6% of the HBT cases affected patients up to 9 years-old. In other studies the main risk groups for HBT identified were young people and adults up to the age of 49 years, followed by old people over the age of 65 years and children under the age of ten years [4].

In Brazil, pediatric HBT is responsible for 60% of hospitalizations and 40% of hospital deaths in that age range. It shows a high incidence and, in this analysis, we shouldn't ignore the possibility of underreporting, principally of the mild events, after which patients may not seek assistance if serious symptoms don't appear. In the group aged 2-12 years, the mild and moderate HBTs are due to falls, while in adolescents they are due to road accidents and sporting activities. The serious HBTs, in both groups, are due to road accidents, except for children under the age of 2 years, who are more often victims of mistreatment at home [12].

When trauma occurs in children under one year old, there is, nearly always, an adult involved, through an act, omission, negligence or failure of the parents or guardian to teach children about dangerous situations or to supervise their activities, as well as ignorance on the part of the parent or guardian in not knowing how to identify danger in the environment or ways in which they could improve their children's safety [13,14].

From the age of five years, other external causes of trauma become more prominent, such as accidents (on the roads, at home, playing sport) and assaults [9,11,12,15]. The greater number of cases of trauma in males [13,14] may be associated with cultural factors, which determine different styles in education, supervision and surveillance of children of different sexes [14], as well as differences in behavior related to the peculiar characteristics of each sex, such as a more aggressive and risk-prone personality trait in boys [15].

In high-income countries, road accidents, self-inflicted violence and interpersonal violence (mainly from physical aggression, assaults and wounds from firearms) are the three major external causes of death among those aged from 15 to 44 years [16].Even in medium- and low-income countries, where infectious and contagious diseases predominate, these three kinds of external causes are among the chief causes of death [7,17].

In general, it was found more HBT cases in males (62.0%) than in females (38.0%). However, this percentages are too close to those found for all the CFT patients (59.0% and 41.0%, respectively), what shows that men are more exposed to CFT in general, but not specifically to HBT. These results agree with those found in Finland, where the incidence of head injuries is higher among boys than among girls (age 0-14) [18].

The causes of HBT are multifactorial, involving physical, economic and sociocultuaral aspects [3,6]. The socioeconomic background, for instance, can be related to HBT statistics, once children residing in less affluent areas seem to be at relatively greater risk of sustaining a fatal head injury than their more affluent counterparts [19]. It may be associated with pathologic psychosocial environments in which negligence and lack of care predominate, in relation to children [17].An important information to be recorded during medical examination in the hospital emergency department is the site of occurrence of the external cause, since it makes preventive actions possible. Unfortunately, most of the patient records we examined did not contain this information.

According to our data, the violence also plays an important role in the development of HBTs, mainly from 15 years-old. Many cases of trauma from external causes are associated with different kinds of violence, whether explicit, such as aggression with weapons, or not, such as road accidents [3]. Although there is no known society in which violence has not existed, since the 1980s it has reached worrying levels, and Brazil has followed this world trend [6].

In metropolitan regions such as Recife, the CFT are responsible for 4.1% of the homicides, violence being reported as the chief cause [20] with young people aged between 15 and 39 years as its main victims and a male:female death ratio of 11:1.

This research, such as other epidemiological studies [4] has demonstrated that traffic has contributed to the increased incidence of CFT since the 1960s. Around 75% of the patients who were victims of road accidents present injuries in the cephalic region, the vast majority

of such accidents having been caused by human failure due to negligence, imprudence and ineptitude on the part of drivers (90%) [4].

Conclusion we consider it important to emphasize that control of the external causes and, consequently of the traumas, depends upon a broad approach in health promotion, which will be able to stimulate preventive actions in the various social spaces, being grounded in the relationship between the health of the community and the socioeconomic characteristics of the environment. In this context, the population should be educated regarding prevention, laying emphasis on children and adolescents as high-risk groups, which have, respectively, falls and urban violence as their major causes for head and brain trauma.

REFERENCES

1. FARAGE, L. et al. As medidas de segurança no trânsito e a morbimortalidade intra-hospitalar por traumatismo crânio-encefálico no Distrito Federal. **Rev Assoc Med Bras.**, Brasília, v.48, n.2, p. 163-166, 2002.

2. EROL, B.; TANRIKULU, R.; GORGUN, B. Maxillofacial analysis of demographic and treatment in 2901 patients: (25-year experience). **J Craniomaxillofac Surg.**, Stuttgart, v. 32, n.5, p. 308-313, 2004.

3. SILVA, O. M. P.; LEBRÃO, M. L. A organização do atendimento da Odontologia Hospitalar e da Traumatologia Buco-Maxilo-Facial no Município de São Paulo. **Rev Odontológic UNESP.**, São Paulo, v. 30, n.1, p.43-54, 2001.

4. KOIZUMI, M. S. et.al. Morbimortalidade por traumatismo crânio-encefálico no Município de São Paulo. **Arq.Neuro-psiquiatr.**, São Paulo, v. 58, n.1, p.81-89, 2000.

5. HOHLRIEDER, M. et.al. Maxillofacial fractures masking traumatic intracranial hemorrhages. **Int J Oral Maxillofac Surg.**, Copenhagen, v. 33, n.4, p. 389-395, 2004.

6. MACKENZIE, E. J. Epidemiology of injuries: current trends and future challenges. **Epidemiol Rev.**, Baltimore, v. 22, n.1, p. 112-119, 2000.

7. SOUZA, E. R.; MINAYO, M. C. S.; SILVA, C. M. F. P. Análise temporal da mortalidade por causas externas no Brasil: décadas de 80 e 90. In: MINAYO, M.C.S.; SOUZA, E.R. (Org.). **Violência sob o olhar da saúde**: a infrapolítica da contemporaneidade brasileira. Rio de Janeiro: Fiocruz, 2003. p. 83-107.

8. CASE, M. E. Abusive head injuries in infants and young children. **Leg Med (Tokyo).**, Tokyo, v. 9, n. 2, p. 83-87, 2007.

9. MELO,R. E. V. A. et al.. Traumatismos Faciais em Crianças e Adolescentes: estudo em 516 Pacientes. **Pesqui. Bras. Odontopediatria Clin.Integr.**, João Pessoa, v. 3, n.1, p. 23-34, 2003.

10. DUHAIME, A. C. et.al. Head Injury in Very Young Children: Mechanisms, Injury Types, and Ophthalmologic Findings in 100 Hospitalized Patients Younger Than 2 Years of Age. **Pediatrics.**, Springfield, v. 90, n.2, p. 179-185, 1992.

11. GASSNER, R. et.al. Craniomaxillofacial trauma in children: a review of 3385 cases with 6060 injuries in 10 years. **J Oral Maxillofac Surg.**, Philadelphia, v. 62, n.4, p. 399-407, 2004.

12. MARTINS, C. B. G.; ANDRADE, S. M. Causas externas entre menores de 15 anos em cidade do Sul do Brasil: atendimentos em pronto-socorro, internações e óbitos. **Rev Bras Epidemiol.**, São Paulo, v. 8, n.2, p.194-204, 2005.

13. HAUG, R. G.; FOSS, J. Maxillofacial injuries in the pediatric patient. **Oral Surg Oral Med Oral Pathol Oral Radiol.Endod.**, St. Louis, v. 90, n.2, p. 126-134, 2000.

14. MARTINS, E. L. M. I.; TORRIANI, M. A.; ROMANO, A. R. Estudo epidemiológico de traumatismos dos tecidos moles da face de pacientes pediátricos. **J Bras. Odontopediatr. Odontol Bebe.**, Curitiba, v.5, n. 25, p. 223-229, 2002.

15. CHAN, J. et.al. The age dependent relationship between facial fractures and skull fractures. **Int J PediatrOtorhinolaryngol.**, Amsterdan, v. 68, n.7, p. 877-881, 2004.

16. ADEBAYO, E. T.; AJIKE, O. S.; ADEKEYE, E. O. Analysis of the pattern of maxillofacial fractures in Kaduna, Nigeria. **Br J Oral Maxillofac Surg.**, Edinburgh, v. 41, n.6, p. 396-400, 2003.

17. SOUZA, E. R.; MELLO JORGE, M. H. P. Impacto da violência na infância e adolescência brasileiras: magnitude da morbi-mortalidade. In: LIMA, CA. (Org.) **Violência faz mal à saúde.** Brasília: Ministério da Saúde, 2004. p. 23-28.

18. PARKKARI, J. et.al. Childhood deaths and injuries in Finland in 1971-1995. **Int J. Epidemiol.**, London, v. 29, n.3, p. 516-523, 2000.

19. WILLIAMSON, L. M.; MORRISON, A.; STONE, D. H. Trends in head injury mortality among 0-14 year olds in Scotland (1986-95). **J. Epidemiol. Community Health.**, London, v. 56, p. 285-288, 2002.

20. RIBEIRO, M. F. P.; CROUCHER, R.; MARCENES, W. Prospective study of maxillofacial trauma in Recife - PE - BRAZIL. **J. Dent. Res.**, Washington, v. 79, p. 380-384, 2000.

Submetido em 25.09.2012;
Aceito em 04.04.2013.