

# Epidemiological Aspects of Cranioencephalic Trauma at Cuiabá Municipal Hospital, Brazil

## Aspectos Epidemiológicos de los Traumatismos Craneoencefálicos Atendidos en el Hospital Municipal de Cuiabá, Brasil

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VASCONCELOS, A. C.; DIAS, J. C.; WIPPEL, M. P. R.; VIEIRA, W. A.; MENESES, I. S.; RIBEIRO, M. A. G. & PARANHOS, L. R. Epidemiological aspects of cranioencephalic trauma at Cuiabá Municipal Hospital, Brazil. *Int. J. Odontostomat.*, 12(1):29-34, 2018.

**ABSTRACT:** Cranioencephalic trauma (CET) is defined as the combination of neural and vascular injuries and their inflammatory effects in the brain, skull and scalp. This modality of trauma may lead to motor, psychological and cognitive sequels or even death. The present study aimed to assess the main epidemiological aspects in victims of CET treated at Cuiabá Municipal Hospital (CMH), Brazil. An observational and analytical study was performed in the medical records of patients diagnosed with CET treated at CMH between July and December of 2000, 2006 and 2011. The information retrieved from the patients consisted of age, sex, place of residence, cause of trauma, association with other trauma, outcomes (death or discharge) and the severity of neurological effect (Glasgow Coma Scale). The data obtained was analyzed descriptively with absolute (n) and relative (%) quantification. Medical records of 669 victims were analyzed, out of which 567 were males (84.7 %). Male patients were aged between 20 and 39 years old (mean age: 32.8 years). The most prevalent cause of trauma was the motorcycle accident (26.6 %). The neurological severity of the CET was mild in most of the cases (32.5 %). Considering the place of residence, most of the patients (n=331; 49.5 %) were from the capital city of Mato Grosso State (Cuiabá, Brazil). Four-hundred seventy-nine (71.6 %) patients progressed without death. A high prevalence rate of CET was observed at CMH. Major attention must be given to young adult victims of motorcycle accidents.

**KEY WORDS:** cranioencephalic trauma, epidemiology, brain injury.

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## INTRODUCTION

Cranioencephalic trauma (CET) is defined as the combination of neural and vascular injuries and their respective effects in the brain, skull and scalp (Huddleston & Ferguson, 2006). The etiology of CET involves external physical forces that eventually result in cerebral lesions and lead to permanent or temporary functional or psychic damages. In certain circumstances patients with CET may progress with death (Farage *et al.*, 2002; Huddleston & Ferguson; David, 2006).

Currently, CET consists of a relevant social problem because it is often related to traffic accidents

(de Moura *et al.*, 2011; Ruy & da Rosa, 2011). Yet the increase in traffic accidents is justified in the growing number of motorcycles and cars in large urban centers. In children and elderly CET often involves accidental falls (Silveira *et al.*, 2011; Ramos *et al.*, 2010) and physical aggression (de Oliveira *et al.*, 2008). The last also figures as the main cause of CET among females (da Silva *et al.*, 2016).

Epidemiological surveys highlight CET as a matter of public health. These studies also show that most of the patients affected are men aged in the third and fourth decades of life – which represent a significant

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part of the society (Ramos *et al.*; de Moura *et al.*; Ruy & da Rosa; Maia *et al.*, 2013). The problem is even worse considering the sequels inherent to CET. It is estimated that nearly 60 % of the patients with CET will progress with motor or cognitive sequels (Helmy *et al.*, 2007). Death rates in these patients are also alarming. According to DATASUS, in 2015 37.306 victims died due to traffic accidents in Brazil (Ministério da Saúde, 2015).

Medical teams must be able to respond optimally to this scenario (Gentile *et al.*, 2011). Moreover, attention must be given to the high rates of CET – especially because the victims usually become high-risk patients. The present study aimed to screen the epidemiological profile of these patients in order to support public health policies in the management and prevention of CET.

## MATERIAL AND METHOD

**Ethical criteria.** The present research was conducted after the approval of the Committee of Ethics in Research of Cuiabá University (UNIC) – protocol number: #813.513 (CAAE: 32487114.8.0000.5165). The retrospective search performed in the archives of Cuiabá Municipal Hospital was guaranteed by the hospital director, assuring legal and ethical standards.

**Type of study and sample characterization.** An observational and analytical study was designed to screen the medical records of Cuiabá Municipal Hospital. Cuiabá is the capital of Mato Grosso State, in Central Brazil, with a population of nearly 585.367 inhabitants. Mato Grosso (MT) State has an estimated population of 3.305.531 inhabitants distributed in 903.202,446 km<sup>2</sup> and 141 cities (IBGE, 2016).

The present study considered only medical records of patients diagnosed with CET treated at Cuiabá Municipal Hospital between July and December of 2000, 2006 and 2011. No restriction was applied on age and sex.

**Data collection and analysis.** The information registered in the medical records were retrieved using data collection forms designed specifically for the present study. These forms included age, sex, place of residence, cause of trauma, association with other trauma, outcomes (death or discharge) and the severity of neurological effect (Glasgow Coma Scale).

**The date was registered in Microsoft Excel files.** The data was explored with absolute (n) and relative (%) descriptive statistics and expressed in tables.

## RESULTS

The search resulted in 669 medical records, out of which 219 (32.7 %) dated from 2000; 184 (27.5 %) from 2006 and 266 (39.8 %) from 2011.

Male patients accounted 547 (84.7 %) records, while females accounted 122 (15.3 %). The age of the sample ranged from 1 month to 91 years (mean age: 32.8 ± 19.1). Considering the sample in age ranges, 190 patients (28.4 %) were aged between 0 and 19 years; 407 (60.8 %) between 20 and 59 years and 68 (10.2 %) >60 years (Table I). The age of the patient was not reported in 0.5 % of the medical records. Regarding the place of residence, 334 (49.9 %) records were registered from the city of Cuiabá, while the remaining 320 (47.8 %) corresponded to other cities. This information was missing in 15 records (2.3 %).

CET was more prevalent in patients involved in motorcycle accidents (n=178; 26.6 %), followed by those who fell (n=151; 22.6 %), those that got run over (n=101; 15.1 %), those driving into traffic accidents (n=87; 13 %), and those suffering aggression (n=48; 7.1 %). Other causes of CET included firearm injuries, contusions, bicycle accidents, accidents with domestic animals, and victims of landslides (n=92; 13.8 %). In 12 records the cause of CET was unclear (1.8 %).

The mean value quantified with Glasgow Coma Scale for neurological effects of CET was 11.02 (±4.05), ranging from 3 to 15. More specifically, 217 (32.5 %) presented mild CET (scale scoring between 14 and 15), 188 (28.1 %) presented moderate CET (between 9 and 13) and 151 (22.5 %) presented severe CET (between 3 and 8). The severity of CET was not registered in 113 (16.9 %) records.

Injuries associated with CET were registered in 330 (49.3 %) records. These injuries included: fractures (of the face, spine, tibia, femur, radius, ulna, shoulder blade and ribs); bruises; otorrhea; lesions in the eyes, abdomen and thorax; aneurysms; other contusions; ecchymoses; amputations; and abrasions.

Table I. Sample characteristics distributed between the years of sample collection.

Characteristics	Year			Total
	2000 (n)	2006 (n)	2011 (n)	
<b>SEX</b>				
Male	190	162	215	567 (84.7%)
Female	29	23	50	102 (15.3%)
<b>AGE</b>				
0-9	17	25	37	79 (11.8%)
10-19	45	30	36	111 (16.6%)
20-39	95	77	90	262 (39.2%)
40-59	42	31	72	145 (21.7%)
>60	16	21	31	68 (10.2%)
n/m	4	0	0	4 (0.5%)
Mean	32.0±17.2	31.9±19.2	34.0±20.1	32.8±19.1
<b>Place of residence</b>				
Capital	86	96	152	334 (49.9%)
Other Cities	127	84	109	320 (47.8%)
n/m	6	4	5	15 (2.3%)
<b>Total</b>	<b>219 (32.7%)</b>	<b>184 (27.5%)</b>	<b>266 (39.8%)</b>	<b>669 (100%)</b>

n: number of records; n/m: not mentioned; age expressed in years.

Most of the patients (n=479; 71.5 %) progressed with hospital discharge, while the remaining (142; 21.2 %) progressed with death. Forty-eight (7.3 %) patients were transferred to other hospitals.

In order to further investigate the aspects considered in the present study, comparisons between variables were performed. Table II shows the association between sex and several causes of CET.

Table II. Relation between the causes of Cranioencephalic Trauma (CET) and sex.

Cause of CET	Sex		n
	Males	Females	
Motorcycle accident	160	18	178
Fall	121	30	151
Run over	71	30	101
Car accident	72	15	87
Aggression	43	5	48
Other	84	8	92
n/m	12	0	12

n: number of records; n/m: not mentioned.

Motorcycle accident was the main cause of CET among males, while in females CET was more prevalent within patients that fell or got run over.

Table III expresses the prevalence of the cause of CET in face of the different age ranges, while Table IV explores the prevalence of these injuries in different time periods. Falling was the most common cause of CET in patients aged between 0 and 9 years old (n=31), between 40 and 59 years old (n=34), and above 60 years old (n=32). Motorcycle accidents were more prevalent in patients aged 10 and 19 (n=33) and between 20 and 39 (n=102) years old (Table III). Motorcycle accidents and falls were the most prevalent cause of CET in 2000, 2006 and 2011 (Table IV).

Table V expresses the prevalence and severity of CET (according the Glasgow Coma Scale) in relation to the clinical prognosis. Most of the patients that progressed with death presented high severity (score between 3 and 8). Only 11 patients with mild severity (score between 14 and 15) progressed with death.

Table III. Prevalence of the causes of Cranioencephalic Trauma (CET) according to age range.

Cause of CET	Age Range					n/m
	0 – 9	10 – 19	20 – 39	40 – 59	>60	
	n	n	n	n	n	
Motorcycle accident	7	33	103	30	3	2
Fall	29	9	34	46	32	1
Run over	25	14	20	21	20	1
Car accident	10	21	36	18	2	0
Aggression	0	8	18	11	9	2

n: number of records; n/m: not mentioned; age expressed in years.

Table IV. Prevalence of the causes of Cranioencephalic Trauma (CET) according to the year of occurrence.

Cause of CET	Year		
	2000	2006	2011
	n	n	n
Motorcycle accident	51	51	76
Fall	41	44	66
Run over	30	23	48
Car accident	41	23	23
Aggression	14	15	19

n: number of records; n/m: not mentioned; age expressed in years.

Table V. Relation between the severity of the lesions and the clinical prognosis.

Glasgow Coma Scale	Clinical Progression		
	Discharged	Transferred	Death
Mild	189	17	11
Moderate	152	12	24
Severe	53	10	88
n/m	85	9	19

Classification scores: Mild: 14-15; Moderate: 9-13; Severe 3-8; n/m: not mentioned.

## DISCUSSION

The present research explored the data registered in medical records of Cuiabá Municipal Hospital (Cuiabá, Mato Grosso, Brazil). In the data, not only the prevalence of CET was considered but also the relation with patient's demographic data. In general, CET was more prevalent in men aged around the third and fourth decades of life victims of motorcycle accidents.

The present study corroborates the scientific literature concerning the prevalence of CET among males (Ramos *et al.*; Silveira *et al.*; de Moura *et al.*; Ruy & da Rosa; dos Santos *et al.*, 2013; Maia *et al.*). The difference in the prevalence of CET based on sex is possibly founded on the risk conditions to which men and women are routinely exposed (Ramos *et al.*). Historical and cultural aspects confirm the fact that men have a higher exposure to risks compared to women.

Similarly, CET was more prevalent among young adults. This finding confirms the scientific literature (Ramos *et al.*; de Moura *et al.*; Ruy & da Rosa; Maia *et al.*) and points towards an alarming scenario. Specifically, young adults compose a large part of the active population. In practice, CET may lead to functional disabilities and hamper labor activities. Possibly, labor disability is the most important social consequence of CET.

In relation to the place of residence, it is important to note that Cuiabá Municipal Hospital is a reference center for attending CET cases in the Mato Grosso State. The present study confirmed the capacity of the hospital showing a similar distribution of patients referred from the capital (n=331) and from other cities (n=313). In a study performed in the city of Salvador, Brazil, the victims attended at the emergency unit were referred mostly from outside the capital (Melo *et al.*, 2004). The present outcomes highlight the importance of having hospitals with emergency capacities for attending both patients from the capital and patients from other cities.

In accordance with previous literature, motorcycle accidents figured as the main cause behind CET (26.6 %) (Ruy & da Rosa; de Moura *et al.*). Usually, traffic accidents involve one of the following aspects: quantity of vehicles, lack of proper road infrastructure, lack of road surveillance, lack of conservation of vehicles, reckless driving and lack of punishment (Marin & Queiroz, 2000). The number of motorcycle in Brazil increased considerably in the last decades. Consequently, related accidents also increased (National Transport Confederation, 2016). Other studies rank falls as the first cause behind CET (Ramos *et al.*; Maia *et al.*). However, in the present study, falls were ranked second among the causes of CET.

Once diagnosed with CET, the patients were examined with Glasgow Coma Scale. This neurological tool aims to assess the severity of cranial lesions through a set of simple commands and their respective responses (Bortolotti, 2012). Based on the responses, the lesions were classified into mild (score between 14 and 15), moderate (score between 9 and 13) and severe (score between 3 and 8) (Bortolotti).

In accordance with the literature (dos Santos *et al.*; de Moura *et al.*), mild lesions were more prevalent in the present study (42.3 %). Mild CET is one of the main reasons in the search for medical urgency and emergency services – not only in hospitals, but also in

public health centers and private offices (Soares *et al.*, 2009). The high prevalence of mild lesions is a positive outcome because it represents a smaller risk condition compared to more severe lesions. In this context, better prognosis may be expected for physical, cognitive and emotional damages (Gentile *et al.*).

Also following what was previously reported in the literature (Maia *et al.*), a large part of the sample manifested lesions other than CET. These lesions are directly related to the cause of the trauma, which is usually from strong physical impacts (Maia *et al.*). This information points towards the importance of having an interdisciplinary team for attending patients with CET, especially because the secondary lesions may affect different regions in the body, such as face, limbs, ribs and organs.

The comparison between the cause of CET and sex revealed that motorcycle accidents were more prevalent in men. In women, CET was more prevalent after falling or getting run over. Most of the population that drives motorcycles consists of men. Consequently, they are more exposed to the inherent risks and accidents. These evidences are confirmed with the outcomes of the present study and the previous literature (Ruy & da Rosa; dos Santos *et al.*).

Considering the causes of CET analyzed in relation to the age, the younger (0-9 years) and older (40-59 and >60 years) patients were more affected with CET after falling. This finding shows how vulnerable these patients can be (Maia *et al.*). In patients aged between 10 and 39 years, motorcycle accident was the most prevalent cause. It is justified by the fact that these subjects are very active, constantly in traffic and exposed to accidents.

The analysis of Glasgow Coma Scale in relation to the clinical progression was also performed and is encouraged in the clinical practice for optimal evaluation of patients with CET. Confirming the literature, the present study observed that the more severe the CET the higher the probability of progressing to death (Saade *et al.*, 2014).

Motorcycle accident was the most prevalent cause of CET during the years in which sampling was performed. According to the National Transport Confederation, four million motorcycles were ridden in Brazil in 2001. In 2011, this number increased to 15 million (National Transport Confederation). Along with the increase in the number of motorcycles there was

an increase in the number of accidents that resulted in CET. This data highlights the need for implementing preventive and educational traffic policies to protect the population.

**CONCLUSION.** The present study revealed that men in the third and fourth decades of life were more affected with CET. Motorcycle accidents figured as the most prevalent cause of CET.

Despite the high number of mild lesions – that evolve with better prognosis, CET still has high morbidity rates.

Considering CET as a matter of public health, preventive and educational policies should be implemented in order to decrease the number of victims.

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**RESUMEN:** El traumatismo craneoencefálico (TCE) se define como una combinación de daño neural, insuficiencia vascular y efectos inflamatorios que comprometen el cráneo, el encéfalo y el cuero cabelludo, causando la muerte, o serias secuelas motoras, psicológicas y cognitivas. De esta forma, el objetivo de este trabajo fue evaluar los principales aspectos epidemiológicos en víctimas de Traumatismo Craneoencefálico (TCE) atendidas en el Hospital y Sala de Primeros Auxilios Municipal de Cuiabá (HPSMC), Brasil. Se trata de un estudio observacional de historias clínicas del archivo del HPSMC, admitidos con diagnóstico de TCE en el período de julio a diciembre de los años 2000, 2006 y 2011. Se consideraron el rango de edad, el sexo, la procedencia de las víctimas, la causa del trauma, la asociación con otros traumas, la defunción y el alta, el cuadro neurológico (Escala de Coma de Glasgow - ECG). El análisis de los datos fue descriptivo con números absolutos y porcentajes. Se evaluaron historias clínicas de 669 víctimas de TCE, en los que el sexo masculino fue el de mayor prevalencia con 567 casos (84,7 %), con mayor incidencia en el rango de edad de 20 a 39 años (39,2 %), el promedio de edad fue de 32,8 años, siendo la etiología más frecuente los accidentes motociclísticos (26,6 %). En el momento de la admisión de acuerdo al ECG hubo una predominancia de TCE leve (32,5 %). En cuanto a la procedencia, 331 (49,5 %) eran del municipio de Cuiabá. Del total de víctimas, 479 (71,6 %) evolucionaron hasta tener el alta hospitalaria. Se registró una prevalencia elevada de TCE en el HPSMC, con predominancia de víctimas adultas jóvenes de sexo masculino, siendo los accidentes motociclísticos la principal causa.

**PALABRAS CLAVE:** traumatismos craneoencefálicos, epidemiología, lesiones encefálicas.

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Received: 20-07-2017

Accepted: 23-12-2017