

Motorcycle-Related Cranio-Maxillofacial Injuries among Brazilian Children and Adolescents

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ABSTRACT

Injuries to the head and face are common in victims of motorcycle accidents. The purpose of this study was to evaluate the occurrence of head and facial fractures among victims of motorcycle accidents in a trauma center. A cross-sectional study was developed through the analysis of 95 medical records of children and adolescents hospitalized due to motorcycle accidents in Campina Grande, Brazil. Data were analyzed with the SPSS software version 18, also using the Pearson's chi-square test. The significance level adopted was 5 %. 77.9 % of victims were male and 22.1 % were female, representing a sex ratio of 3.5:1. As for age group, most had between 10 and 19 years (87.4%) and with respect to the day of the week, 55.8 % of incidents occurred over the weekend. The existence of bone fractures was observed in 85.3 % of victims and 17.9 % had fractures in the head and face. The occurrence of deaths was 3.2 %. There was association between age group and sex ($p = 0.001$). The motorcyclist road traffic accidents are more common in young male individuals and occur on weekends, with a male to female ratio of 3.5:1. The occurrence of bone fractures was high and most victims had a single injury however the number of deaths was very low.

Keywords: Accidents, Traffic; Facial Injuries; External Causes.

INTRODUCTION

Motorcycle related injuries have become a major public health problem¹ and the increased use of motorcycle is accompanied with increased road traffic accidents. Some researchers have investigated the epidemiology of motorcycle accidents in different countries and populations^{1,2}. In 2005 in Brazil, more than 35,000 people were

victims of traffic accidents, which correspond to the average of 98 deaths per day³.

Motorcycle crashes, the commonest form of road traffic accidents, occur mostly in economically active population and the annual costs of road traffic accidents are estimated to be between US\$65 and \$100 billion⁴. Therefore, road traffic accidents cause loss of production equivalent to 2 % of the gross domestic product of the entire world economy⁵.



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The motorcycle is known as the most dangerous motor vehicle because for each mile that vehicle passes, motorcycle riders have a 34-fold higher risk of death in a crash than people driving other types of vehicles, and the chance of injuries is eight times more compared to other vehicles⁶.

Motorcycle accidents are the most common cause of maxillofacial fractures in Brazil^{7,8}. The facial region is a commonly fractured site, but the etiology varies widely by country and geographic region⁹. The injury mechanisms relating to traffic accidents may vary greatly, either through the gradual increase in the body's resistance, or because of the many types of impact that children may be subjected to at different ages⁸.

Most patients are male and have fractures caused by motorcycle accidents (31.5%)⁹. In Brazil, a previous study showed a frequency of 20% head injuries among adolescent victims of automobile accidents⁷. Head injuries have been found to be the greatest cause of fatality in most motorcycle injuries¹.

Motorcycle injuries contribute a substantial number of hospital admissions and deaths in Brazil. Therefore, this study assessed the occurrence of head and facial fractures among children and adolescents victims of motorcycle accidents.

MATERIAL AND METHODS

Study Design

A cross-sectional study was carried out by means of analysis of medical records of children and adolescents hospitalized due to motorcycle accidents at the Regional Hospital of Emergency and Trauma at Campina Grande, Paraiba from January 2014 to December 2014. The city has an estimated population of 407,754 habitants and a municipal human development index (HDI) value of 0.72.

Data Collection

Study subjects were all motorcyclists who have been injured or died in road traffic injury (RTIs) between January and December 2014. The sample consisted of 95 medical reports of children and adolescents affected by motorcycle accidents duly confirmed.

A pilot study was carried out and reports considered illegible or incomprehensible were considered an exclusion criterion. A motorcycle injury was defined as any injury resulting from a motorcycle traffic accident regardless of the severity or outcome¹.

For data collection, a form was created with variables related to the sociodemographic characteristics of the victims (sex and age [0 to 9 years; 10 to 19 years]), trauma characteristics (day of the week, injury pattern (presence of bone fractures, fractures in the head (ICD-10 S01) and face (ICD S09), and the occurrence of death). Due to the inaccessibility of high quality data about the damaged people who died immediately after the occurrence of accident or people that died after release from hospital, this study only considers the hospital mortality in motorcyclists¹⁰.

Statistical Analysis

In data analysis, descriptive and inferential statistical techniques were used. The statistical techniques involved obtained absolute distributions, percentages and statistical measures: mean, median and standard deviation. For bivariate analyses, the Chi-square test was used. The statistical significance level was set at 5%. The statistical program used was the SPSS software (Statistical Package for the Social Sciences) version 18.

Ethical Aspects

The study was approved by the Ethics Research Committee, under the Protocol no. 1.380.545.

RESULTS

Out of 95 victims of motorcycle accidents, 74 (77.9%) involved male patients and 21 (22.1%) were related to female patients, representing a sex ratio of 3.5:1. The age of respondents ranged from 1 to 19 years, with mean of 15.0 years, median of 16.0 years and standard deviation of 4.5 years. As for the age group, the majority of the victims aged from 10 to 19 years (87.4%) and with respect to day of the week, 55.8% of cases were registered during the weekend (Saturday and Sunday).

Table 1 shows the association between variables age group and sex ($p = 0.001$), revealing that the highest percentages occurred in the age group from 10 to 19 years and the percentage of motorcycle accidents was higher among males than among females.

The occurrence of bone fractures was 85.3% and most victims had a single injury (67.9%). Bivariate analysis not revealed an association between the age and bone fractures ($p = 0.377$), number of fractures ($p = 0.052$), skull and facial

fractures ($p = 1.000$) and fractures in other regions ($p = 0.421$) (Table 2). The percentage of patients with fractures, multiple fractures and skull and facial fractures were correspondingly higher among victims of 10 to 19 years. The number of deaths was very low (3.2%).

DISCUSSION

This study presents an analysis of a major comprehensive hospital in a city concerning the hospitalized motorcycle injury victims. Most of the

Table 1: Distribution of victims of motorcycle accidents according to age, sex and day of week

Variables	Age Group (Years)				Total	P -value	
	0 to 9		10 to 19				
	n	%	n	%			
Sex							
Male	5	6,8	69	93,2	74	100.0	0.001
Female	7	33,3	14	66,7	21	100.0	
Day of the Week							
Saturday/Sunday	8	15.1	45	84.9	53	100.0	0.417
Monday - Friday	4	9.5	38	90.5	42	100.0	

Table 2: Presence of bone fractures, number of fractures, fractures in the skull and head, others regions and death

Variables	Age Group (Years)				Total	P -value	
	0 to 9		10 to 19				
	n	%	n	%			
Presence of Bone Fractures [95]							
Yes	9	11.1	72	88.9	81	100.0	0.377
No	3	21.4	11	78.6	14	100.0	
Number of Fractures [81]							
Single	9	16.4	46	83.6	55	100.0	0.052
Multiple	0	0.0	26	100.0	26	100.0	
Skull and Facial Fractures [81]							
Yes	2	11.8	15	88.2	17	100.0	1.000
No	10	12.8	68	87.2	78	100.0	
Fractures in other body regions [95]							
Yes	7	10.8	58	89.2	65	100.0	0.421
No	5	16.7	25	83.3	30	100.0	
Death [95]							
Yes	0	0.0	3	100.0	3		1.000
No	12	13.0	80	87.0	92		

epidemiological studies on motorcycle accidents have been performed retrospectively^{2,8,11-15} and road traffic accidents are among the main etiologic factors of maxillofacial injuries^{11,14-17}.

Increasing use of motorcycles for private and commercial purposes has also been reported in Brazil^{17,18} and other countries¹⁹. The growing number of motorcycles could be attributed to the inefficiency and high cost of public transportation²⁰. Motorcyclists are particularly vulnerable to injury because there is little or no protection provided in the event of a crash.

The Regional Hospital of Emergency and Trauma of Campina Grande represents the only public health service with high complexity and reference to the care of patients suffering from external causes in the hinterland of the state of Paraíba¹⁸.

Good quality information on characteristics of victims, types, and frequency of injuries, causes of accidents, vehicles involved in injury and outcome is essential for understanding and planning required for managing the trauma epidemic¹⁴.

The transportation of children and adolescents on motorcycles is a common practice in small- and medium-sized Brazilian cities such as Campina Grande, where the present study was conducted, because this is the main means of transportation among the low-socioeconomic-status population^{7,21}. The low cost of purchase, easy maintenance and fuel consumption has continued to favour an increase in motorcycle transportation.

The lack of interest in wearing a motorcycle helmet or seat belt, bad road conditions, non-application of road traffic rules (negligence and recklessness while driving) or inadequate traffic law enforcement by police (especially in case of motorcyclists) may explain the reason for road traffic accident²².

The analysis of gender and age distribution showed that the highest prevalence of motorcycle accidents involved male victims aged 10 to 19 years, which is consistent with findings of previous studies². Road traffic accidents were found to be the known cause of injuries as the age increases¹⁶.

A huge majority of motorcycle accident victims in this study were males (77.9%) and it is similar to the findings in studies done in Taiwan (71.3%)², India (83.5%)¹⁴ and Iran (89.3%)¹⁰. The sex ratio in this study was lower than that observed in Iran (3.5:1 versus 8.4:1)¹⁰ and Nigeria (3.5:1 versus 4.8:1)¹⁵. According to some authors, while men are predominantly riders, women are mostly passengers²⁰. It can be hypothesized that males are more involved in risk-taking behavior such as alcohol consumption, mobile in nature, and engage in outdoor activities more than their female counterparts resulting in heightened risk of accidents (4,8). In addition, non-use of safety devices, excess speed²³ and unlicensed drivers²⁴ are considered as risk factors for morbidity and mortality.

With respect to the day of the week, motorcycle accidents occurred more frequently on weekends, corroborating previous findings^{7,18}. The higher occurrence on weekends may be related to risky behavior in traffic such as driving over the speed limit, disrespect of traffic rules, and driving under the influence of alcohol⁷.

There are many types of injuries that can be sustained during a motor vehicle accident. Injuries to the head and face are common and range in severity from scrapes and bruises, to laceration and bone fractures and dental trauma^{25,26}. These injuries often cause disability and long term deformity, and these may have social and psychiatric consequences²⁷. Quality of life is an important outcome for evaluating the impact of disease²⁸ and the physical dysfunction and disfigurement caused by some of the injuries may adversely affect the patients' ability to undertake their daily activities, and also lower their mood and sense of self-esteem²⁷.

The etiology of maxillofacial injuries varies from one country to another and even within the same country depending on the prevailing socioeconomic, cultural and environmental factors¹¹.

The occurrence of bone fractures was high and most victims had a single injury. The percentage of patients with multiple fractures and skull and facial fractures were correspondingly higher among victims of 10 to 19 years. A previous study found a prevalence of 21.4% to skull fractures and 18.5% to

facial fractures²⁶. Pediatric patients sustain distinct patterns of injuries from causes that differ from those of adults because of their unique anatomical, physiologic, and behavioral characteristics². In 2013, the Brazilian National Transit Council (CONTRAN) released official instructions regarding the adequate helmet wearing and its mandatory use for motorcyclists²⁰.

The incidence of head injury in patients with maxillofacial injuries could be attributed to transfer of force from the facial skeleton to the cranium¹⁵. Helmets demonstrate a protective effect and may be an effective public health intervention to significantly reduce the burden of traumatic brain injury in Cambodia and other developing countries with increasing rates of motorization across the world²⁹.

Patients with road traffic maxillofacial injuries have high susceptibility to concomitant injuries in other regions of the body. Craniofacial trauma and injuries associated with the maxillofacial region are highlighted in the context of multiple fracture patients, especially for being an area related to the occurrence of many types of injuries whether isolated or associated with other organs^{13,30}. However, cultural differences, sports activities, daily tasks, occupational status and strict driving rules might affect the etiology of maxillofacial traumas, leading to discrepancies between various studies¹⁹.

In this study, the number of deaths was very low. A previous study showed that the majority of patients died on scene, followed by a consistent decrease during the post-traumatic period³¹.

There are some limitations in this study. First, the retrospective design and the lack of available data regarding conditions including speed, alcohol and helmet design and material. Secondly,

data of on deaths occurring after hospitalization and could not be collected at the accident scene. Therefore, the mortality and injury patterns described here are large underestimations of the absolute mortality risks associated with accident types¹.

External causes (accidents and violence) are of substantial importance in public health, given their magnitude and impact on people's lives, particularly in developing countries³². Public policies for motorcycle accidents prevention should be as effective as the market policies toward the increase of motorcycle selling. Stricter rules to obtain drivers' license, effective transit surveillance, and investments in traffic engineering are fundamental actions to enhance the safety of motorcycle use²⁰.

The Human Development Index (HDI) could be an explanatory variable to understand the factors that influence the increased morbidity, since HDI is based on three pillars: education, income and longevity¹³. Education relating to traffic, especially for the infant and child population, is one of the instruments that may contribute in the medium and long terms toward reducing the alarming traffic accident rates^{8,33}.

CONCLUSION

The motorcyclist road traffic accidents are more common in young male individuals and occur on weekends, with a male to female ratio of 3.5:1. The occurrence of bone fractures was high and most victims had a single injury, however the number of deaths was very low.

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