Crash characteristics and patterns of injury among hospitalized motorcyclists: retrospective emergency study

Características de acidentes e padrões de lesões em motociclistas hospitalizados: estudo retrospectivo de emergência

Características de accidentes y patrones de lesiones en motociclistas hospitalizados: estudio retrospectivo de emergencia

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Abstract

Objective: To describe the characteristics of motorcycle accidents and victims hospitalized in Brazilian a large hospital and reference in trauma.

Methods: A documentary research study was developed with a sample of 343 motorcycle accident victims hospitalized at the Hospital of Restoration in the year 2014. Data was collected in patients' medical records. Demographic variables were analyzed; related to the circumstances of the accident, clinics and treatment. The Epi Info 7 program was used, through descriptive statistics for analysis. Pearson's Chi-square test was used to analyze proportions. In cases where the assumptions of the chi-square test were not satisfied Fisher's exact test was applied. All conclusions were drawn considering the level of significance of 5%.

Results: The largest number was male (87.5%), in the age group of 20 to 29 years (34.7%), unmarried (86.7%). The highest frequency of accidents was in on Sunday (25.1%) and at night (32.1%). The most affected body region was the head (43.9%). The mean length of hospital stay was 15.9 ± 23.8 (1-161) days. The main outcome was hospital discharge (88.5%). The proportion comparison test was significant in all variables analyzed (p-value <0.001). 51 (14.8%) of the victims suffered some kind of side effect.

Conclusion: The profile of the victims was 20 to 29 years old, male, with the head being the most affected body area. The profile of hospitalizations due to motorcycle accidents in a trauma hospital, brings relevant information on the characteristics of victims and accidents, which may provide subsidies for injury prevention strategies.

Resumo

Objetivo: descrever as características dos acidentes de motocicleta e das vítimas hospitalizadas em um hospital de grande porte e referência em trauma no Brasil.

Métodos: foi realizada uma pesquisa documental com uma amostra de 343 vítimas de acidentes de motocicleta internadas no Hospital de Restauração no ano de 2014. Os dados foram coletados nos prontuários dos pacientes. As variáveis demográficas foram analisadas e relacionadas a circunstâncias do acidente, clínicas e do tratamento. O programa Epi Info 7 foi utilizado para análise estatística descritiva. O teste do qui-quadrado de Pearson foi utilizado para analisar proporções. Nos casos em que as premissas do teste do qui-quadrado não foram satisfatórias, foi aplicado o teste exato de Fisher. O nível de significância de 5% foi considerado para todas as conclusões.

Resultados: o maior número de acidentes envolveu o sexo masculino (87,5%), na faixa etária de 20 a 29 anos (34,7%), solteiros (86,7%). A maior frequência de acidentes ocorreu aos domingos (25,1%) e à noite (32,1%). A região corporal mais afetada foi a cabeça (43,9%). O tempo médio de internação foi de 15,9 ±

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23,8 (1-161) dias. O desfecho principal foi alta hospitalar (88,5%). O teste de comparação de proporções foi significativo para todas as variáveis analisadas (valor de p <0,001). Algum tipo de sequela afetou 51 (14,8%) vítimas.

Conclusão: o perfil das vítimas foi sexo masculino, idade entre 20 e 29 anos e a cabeça como área corporal mais afetada. O perfil das internações por acidente de motocicleta em um hospital de trauma traz informações relevantes sobre as características das vítimas e dos acidentes, que podem auxiliar no desenvolvimento de estratégias de prevenção de lesões.

Resumen

Objetivo: Describir las características de los accidentes de motocicleta y de las víctimas internadas en un hospital de gran tamaño y referencia en trauma de Brasil.

Métodos: Se realizó una investigación documental con una muestra de 343 víctimas de accidentes de motocicleta internadas en el Hospital de Restauração en 2014. Los datos se recolectaron de las historias clínicas de los pacientes. Se analizaron las variables demográficas y se las relacionó con las circunstancias del accidente, clínicas y del tratamiento. Para el análisis estadístico descriptivo, se utilizó el programa Epi Info 7. Para analizar proporciones, se utilizó la prueba χ^2 de Pearson. En los casos en que las premisas de la prueba χ^2 de Pearson no fueron satisfactorias, se aplicó la prueba exacta de Fisher. Se consideró el nivel de significación de 5% en todas las conclusiones.

Resultados: En el mayor número de accidentes, los involucrados fueron del sexo masculino (87,5%), del grupo de edad de 20 a 29 años (34,7%), solteros (86,7%). La mayor frecuencia de accidentes ocurrió los domingos (25,1%) y a la noche (32,1%). La región corporal más afectada fue la cabeza (43,9%). El tiempo promedio de internación fue de 15,9 ± 23,8 (1-161) días. El desenlace principal fue el alta hospitalaria (88,5%). La prueba de comparación de proporciones fue significativa en todas las variables analizadas (valor de p <0,001). Algún tipo de secuela afectó a 51 (14,8%) víctimas.

Conclusión: El perfil de las víctimas fue de sexo masculino, edad entre 20 y 29 años y la cabeza fue la zona corporal más afectada. El perfil de las internaciones por accidente de motocicleta en un hospital de trauma proporciona información relevante sobre las características de las víctimas y de los accidentes, que pueden servir para la elaboración de estrategias de prevención de lesiones.

Introduction

Traffic accidents are among the leading causes of death, hospitalization and disability. It is estimated the number of fatal victims in traffic is 1.3 million, and up to 50 million non-fatal casualties per year throughout the world. The World Health Organizations states that, without preventive action, traffic accidents will increase until becoming the 7th cause of death by 2030, and that about 90% of global road traffic mortality occurs in low- and middle-income countries, even though these countries have half of the vehicles in the world.[1]

In most low- and middle-income countries, compared to high-income countries, a much larger portion of users of roads are pedestrians, cyclists and motorcyclists, and almost half of the fatal injuries caused by traffic occurs among motorcyclists.[2] Motorcyclists are more exposed to fatalities and injuries.[3] A study on the risk of motorcycle rider injury due to collision speed and other factors involved, found a strong and significant relationship between relative speed and injury severity in motorcycle crashes.[4] At a speed of 70 km/h, the risk of serious injury from collisions with large objects, impact barriers and narrow objects was 20%, 51% and 64% respectively.[4] In addition, frontal collisions between motorcycles and passenger cars with both vehicles at 60 km/h (relative speed of 120 km / h) have been found to present a 55% risk of serious injury to the rider.[4] Although injuries in the lower limbs occur most commonly in all motorcycle accidents, head injuries are more frequent in fatal collisions.[5,6]

In recent decades, an increased traffic of motorcycles has been observed in many areas of the world and security persists as a major challenge. Several risk factors are involved in accidents with motorcyclists, emphasis given to those related to infrastructure (road type and geometry, roadside installations, lighting and visibility, joint type, and pavement conditions).[4,7] Participants' characteristics and behaviors, such as speeding, alcohol, use of helmet, sex and age are also risk factors to these accidents.[8]

In Mexico, motorcycles represent 13.14% of the total number of deaths in road accidents.[9] A study conducted in Iran identified that 43.4% of traffic accidents were with motorcycles, with a majority of males (86.2%).[10] While young people make up 10% of the driver population, the motorcycle accident fatality rate is three times higher.[11] In a study in Africa, motorcycle accidents accounted for 57% of all traffic accidents, with mostly male victims, of low socioeconomic status and aged between 20 and 40 years.[5]

In Brazil, motorcycle accidents are an important epidemiological problem. There is a tendency of

growth in mortality rate, which supplanted that of accidents with cars. From 1990 to 2015, the death rate of motorcycle riders was 5.9/100 thousand.[12] The linear trend of mortality among motorcyclists increased significantly in all Brazilian macroregions, with the highest annual variation recorded in the Northeast.[13] Study on the potential years of life lost due to accidents involving motorcycles in the State of São Paulo identified rates of 486.9 for ages from 20 to 29 years and of 199.5 for 30 to 39 years old, showing the impact of those deaths on society.[14]

Add to that the impacts of non-fatal injuries on the Unified Health System (SUS). Of a total of 170,805 hospitalizations recorded in the In-patient Hospitalization System (SIH) in 2013, 51.9% were due to motorcycle accidents.[15] Such hospitalizations show the severity of injuries and will directly influence the health costs, which are often difficult to estimate due to the social costs involved. They have impacts on the mortality and morbidity profile, representing a major challenge to public health.[16] This study aims at describing the characteristics of motorcycle accidents and their victims admitted to a large hospital, reference in the treatment of trauma.

Methods

This is a documentary research (medical records) carried out at the Hospital da Restauração Governador Paulo Guerra. Such hospital is part of the public health network in the State of Pernambuco and the main reference for victims of polytrauma. It is estimated that 10,000 emergency calls and 13,000 outpatient services are provided monthly, as well as 2,200 hospitalizations and 800 surgeries. For sample calculation, the Openepi program (https://www.openepi.com/Menu/OE_Menu.htm) was used, with the following parameters: population size of 2,195 motorcycle accident victims attended during the year studied (2014), prevalence of 50%, 5% variation and 95% confidence level, obtaining n = 328. Data was collected by consulting the patients' medical records made by the responsible researcher, from January to December. July 2016. This data was transcribed in an instrument developed for the research. Demographic variables (sex, age group, marital status and origin) were analyzed, as well as those related to the circumstances of the accident (day of week, time, month, use of helmet and alcoholic beverages), and clinical and treatment (location of injury, ECG, type of treatment, length of hospital stay, death, outcome, after-effects, and specialty care after discharge). Variables mechanism of trauma (43.7%) and number of injuries (19.0%) were excluded from the analysis due to the high proportion of non-filling.

For data analysis, the program Epi Infor 7 was used, through descriptive statistics (frequency distributions, measures of central tendency and dispersion). The research was approved by the Research Ethics Committee of the University Hospital Oswaldo Cruz of the University of Pernambuco (CAAE No. 50163215.0.0000.5192), protocol number 1.315.56 of November 10, 2015.

Results

The study population consisted of 343 motorcycle accident victims hospitalized, from January to December 2014. Table 1 shows the demographic characteristics of motorcycle accidents victims. The mean age was 29.9 ± 12.4 years old. The greatest casuistic was male (n=300; 87.5%), between the ages of 20 and 29 years old (n=119; 34.7%), single (n=255; 86.7%), resident in municipalities in the interior of the state (n=10; 61.8%).

The highest frequency of accidents occurred in September (n=39; 11.4%), on Sundays (n=86 25.1%) and at night time (n=110; 32.1%), as noted in table 2. Motorcyclists reported wearing a helmet (n=312; 91.0%) and not having consumed alcohol (n=240; 70.0%) (Table 2).

Table 3 describes the characteristics of injuries and the treatment of victims. The most affected body region was the head (n=163; 43.9%); however, the Glasgow Coma Scale (GSC) value that prevailed was mild (n=240; 82.5%) and most stayed up to 7 days in the Hospital (n=194; 57.1%). Mean length of hospital stay was 15.9 ± 23.8 (1-161)

Table 1. Demographic characteristics of motorcycle accident victims

Variables	n(%)
Sex	
Male	300 (87.5)
Female	43 (12.5)
Age group (in years)	
0-9	8(2.3)
10-19	58(16.9)
20-29	119(34.7)
30-39	94(27.4)
40-49	38(11.1)
50-59	14(4.1)
60 and older	11(3.2)
Marital status	
Single/widowed	255(86.7)
Married/Consensual union	39(13.3)
Origin (n=340)	
Recife	54(15.9)
Metropolitan region of Recife	76(22.4)
Other municipalities in the state	210(61.8)

Table 2. Characteristics of accidents involving motorcyclists

Variables	n(%)
Month of occurrence	
January	19(5.5)
February	25(7.3)
March	28(8.2)
April	36(10.5)
May	35(10.2)
June	26(7.6)
July	27(7.9)
August	33(9.6)
September	39(11.4)
October	37(10.8)
November	38(11.1)
Day of occurrence	
Sunday	86(25.1)
Monday	66(19.2)
Tuesday	35(10.2)
Wednesday	27(7.9)
Thursday	34(9.9)
Friday	35(10.2)
Saturday	60(17.5)
Time of occurrence (n=336)	
Morning (07-12:59))	47(14.0)
Afternoon (13-18:59)	76(22.6)
Night (19-23:59 h)	133(39.6)
Dawn (01-06:59)	80(23.8)
Use of helmet (n=342)	
Yes	312(91.0)
No	30(8.7)
Use of alcohol (n=342)	
Yes	102(29.7)
No	240(70.0)

days. The main outcome was hospital discharge (n=284; 88.5%) and there were 22 deaths (6.4%). Of the 343 motorcyclists hospitalized, 51 (14.8%) presented after-effects (Table 3). Orthopedics outpatient clinic (n=68; 32.4%) was the most indicated for continuation of treatment after hospital discharge (Table 3). There was estrangement from work in 27.7% of the cases and the average time of absence was 43.5 ± 24.3 (3-120) days.

Table 3. Characteristics of injuries and treatment to victims of motorcycle accidents

Variables	n(%)
Location of the injury*	
Head	163(43.9)
Facial	73(19.6)
Upper limbs	64(17.2)
Lower limbs	51(13.7)
Abdominal	15(4.0)
Thoracic	3(0.8)
Spinal cord injury	3(0.8)
Glasgow Coma scale (n=291)	
Severe (3 to 8 points)	30(10.3)
Moderate (9 to 12 points)	21(7.2)
Mild (13 to 15 points)	240(82.5)
Treatment**	
Surgical	154(40.4)
Conservative	195(51.2)
Intensive Care Unit	32(8.4)
Length of hospital stay (n=340)	
Up to 7 days	194(57.1)
From 8 to 14 days	44(12.9)
From 15 to 21 days	26(7.6)
From 22 to 30 days	11(3.2)
Over 30 days	65(19.1)
Outcome (n=321)	
Transference	35(10.9)
Evasion	2(0.6)
Discharge	284(88.5)
Death	
Yes	22(6.4)
No	321(93.6)
After-effects (n=331)	
Yes	51(15.4)
No	280(84.6)
Specialty forwarded to***	
Orthopedics	80(38.1)
Neurosurgery	55(26.2)
Oral and maxillofacial	42(20.0)
Physical therapy	26(12.4)
General Surgery	3(1.3)
Speech therapy	2(1.0)
Pediatrics	2(1.0)

*The total exceeds the number of occurrences, as the same patient can present lesions in more than one location. **The total exceeds the number of occurrences, as the patient may have been subjected to more than one treatment. ***The total exceeds the number of occurrences, as the patient may have been forwarded to more than one outpatient clinic

Discussion

The study results show that young adults, aged from 20 to 29 years old and male were the man victims of motorcycle accidents, similar to other studies.[14,17,18] A research analyzing the characteristics of motorcyclists involved in traffic accidents, admitted to public urgency and emergency services of Brazil, identified a similar profile.[17] In the state of Rio Grande do Norte, the profile of motorcyclists treated by a pre-hospital emergency service revealed similar characteristics with a predominance of men aged 25-34 years.[19] Likewise, a research on the clinical characteristics of motorcyclists involved in accidents showed they were almost all male and aged 16 to 35 years.[20] In Iran, a research compared the profile of patients according to sex and age in a trauma center, finding that automobile and motorcycle accidents prevailed among men from 15 to 44 yeas old.[21]

Several factors contribute to the risk of accidents of motorcyclists: sex, age, experience, personality traits.[22] The greatest exposure of young men, identified in this study, is possibly associated to social and cultural behaviors, which may imply in dangerous behaviors. Such behaviors include the non use of helmet when driving motorcycles, driving while intoxicated, non compliance with driving rules, and lack of control of high speeds.[23] There is a significant correlation between lifestyle and risk behavior of motorcycles with involvement in traffic accidents.[22]

In Australia, a research conducted aimed at understanding the behaviors associated with the risk of collision, whose sample was composed mostly by men, indicated that speed violations and errors related to motorcycle control increased the chances of being involved in a collision.[24]

The risk of accidents due to overspeed must also be highlighted. A study on the exposure factors of the motorcycle fleet related to the risk of serious accidents revealed a significantly greater proportion of motorcyclists exceeding the speed limit when compared to other vehicles (6 vs. 3%, respectively).[25] Study on the risk of injury for motorcyclists due to collision speed revealed that, at 70 km/h, the risk of at least serious injury in collision with large objects, barriers and narrow objects was 20%, 51% and 64%, respectively.[4] In addition, it was found that frontal collisions between motorcycles and passenger card, with both vehicles at 60 km/h (a relative speed of 120 km/h), showed 55% risk of severe injury for the motorcyclist.[4]

Regarding month of occurrence, the study noted that accidents occur homogeneously throughout the months of the year, but there is a concentration on weekends, especially on Sunday and at night. The highest frequency of accidents in weekends and at night may be related to festive events and the ingestion of alcoholic beverages, which increases in these periods.[26] In Mexico, the analysis of accidents with motorcyclists showed Saturday and Sunday as days of greater probability of occurrence of accidents (OR 1.65) in comparison with the other days of the week.[9]

The results of this study showed that about 70% of the respondents stated they have ingested not alcohol at the time of the accident. Study on the impact of the Brazilian Code of Traffic and of Prohibition on mortality due to traffic accidents observed a reduction of mortality rate for traffic accidents after their deployment; however, no significant reduction was found for the category of motorcyclis.[18] Research on the prevalence of alcohol and drugs among death motorcyclists in traffic accidents in Norway showed that the presence of these substances in the blood was found mainly among cyclists from 25 to 34 years of age in accidents on weekends and at night.[27] In the city of São Paulo, the culpability coefficient estimated for motorcyclists positive for alcohol was three times greater than for those without alcohol.[28]

The risk of accidents admittedly may increase with the use of alcohol and other drugs, damaging awareness and problem-solving skills of the driver. In addition, drives under the influence of alcohol or substances do not consider the consequences of their behavior and actions on others. This may increase the risk of involvement in or casing an accident.[29]Among fatally wounded motorcyclists, the use of alcohol is significantly associated to risk behavior, such as not wearing the helmet.[30]A relevant

portion of accidents would be preventable if more efficient limitations could be applied against driving after the ingestion of substances or alcohol.

In this study, the had was the body part most affect by trauma, although more than 90% of the motorcyclists claimed to be using a helmet at the time of the accident. Despite evidence that wearing a helmet reduces injuries and mortality associated with motorcycle accidents, the use of helmets is not universal among motorcyclists. In Brazil, the use of helmet is mandatory; failure to use represents a very serious infringement. A research identified that the use of helmet by motorcyclists involved in accident resulted in a reduction of 69% in cranial fractures, 71% in cerebral contusion, and 53% in intracranial hemorrhage.[31]

Furthermore, most motorcyclists had more than one injury. Motorcyclists are vulnerable in the traffic, as the vehicle has not additional security equipment besides the helmet. The analysis of land transport accidents performed in the city of Olinda (PE), showed motorcyclists as the main victims.[32] In an accident, the motorcyclist has a higher chance of being seriously injured because there is no external steel structure to absorb impact forces, in comparison with car occupants.[20] The motorcyclist receives the force and impact of the accident. The common mechanism of injury is front impact or ejection due to the abrupt halt of the motorcycle at the time of impact. The forward motion of the motorcyclist may lead to multiple injuries, as a result of impact on asphalt or on parts of the motorcycles. Most injuries involving a motorcyclist include head, thoracic and abdominal lesions.[33]

The average length of hospital stay in this study was seven days, similar to that found in the analysis of hospitalizations due to injuries arising from land transport accidents in Brazil in 2013, whose length of stay for victims of motorcycle accidents was 6.1 days.[15] In Salvador (BA), the average hospitalization of injured motorcyclists was 4.2 days.[34] In the state of Piaui, the average length of stay was 4.5 days.[35]

In this study, over 80% of the motorcyclists involved in accidents were classified by the Glasgow Coma Scale as mild (13 to 15 points). Similarly, a study that analyzed injuries resulting from motorcycle accidents treated at a hospital in Cameroon found that most patients had minor injuries.[36]

Regarding the occurrence of after-effects, we observed thy were present in more than 15% of the sample studied, consistent with results of a study that assessed hospitalizations and found the most affected victims were the motorcyclists in ATT hospitalizations associated with after-effects. The use of motorcyclist protection devices, such as helmet and limb protection, contributes to reduce the severity and possible after-effects.[37]

Study limitations include the issue of quality of the clinical data available in the medical chart records. We understand that the quality of trauma description and severity can be improved to provide accurate reporting on motorcyclists involved in accidents. Another limitation is the fact this is a hospital-based study, although this is the main reference hospital in the state. These data can be use as an observatory of motorcycle accidents and be useful to the medical community, society and health managers.

Conclusion

The characteristics of the victims of motorcycle accidents studied, emphasized the presence of young adult men. Most of the accidents occurred at the weekend and at night time. The main affected area was the head and the helmet was worn at the time of the accident. The profile of hospitalizations due to motorcycle accidents in a trauma hospital brings relevant information on the characteristics of victims and accidents, which may provide subsidies for injury prevention strategies. Primary prevention with application of traffic rules and road safety measures should be the key to reducing morbidity and mortality in accidents involving motorcyclists. Likewise for the knowledge on the types and severities of injuries, contributing to the management planning and training of professionals for the first service in the health unit, the gain of time and service quality, this reducing risks of death and future after-effects.

Collaborations

Monteiro CSG, Almeida AC, Bonfim CV and Furtado BMASM declare that they contributed to project design, data analysis and interpretation, article writing, critical review of the intellectual content and final approval of the version to be published.

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