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Risk factors for amputation in traffic accident victims

Factores de riesgo de amputación en víctimas de accidentes de tráfico**Fatores de risco para amputação em vítimas de acidentes de trânsito****ABSTRACT**

Objective: To analyze the risk factors for traumatic amputation in victims of traffic accidents. **Methodology:** This is an epidemiological, retrospective, descriptive and analytical study, with a quantitative approach, carried out in a quaternary reference hospital in trauma, in the city of Recife-PE. The population was composed of individuals who were victims of traffic accidents, hospitalized in the adult traumatology sector and who underwent amputation surgery. The non-probabilistic sample, for convenience, consisted of 70 patients who underwent amputation surgery during the period from July 2014 to June 2018. **Results:** Most were male (82.9%); in the age group of 18 to 39 years (62.9%); single (60%), the most frequent type of accident was a motorcycle fall with 34.3%; 60% were the driver and 27.1% were pedestrians; 11.4% did not use safety equipment; and 11.4% used alcohol. The most frequent injuries corresponded to multiple injuries (48.6%); 42.8% were hospitalized less than 30 days (42.8%); 14.3% were admitted to the ICU and remained from 1 to 84 days; the most frequent type of amputation (57.1%) was transfemoral, 27.1% transtibial and the remaining 15.7% were of other types. **Conclusion:** The study's findings regarding the risk factors for traumatic amputation did not show a significant association, but contribute to investigate the risk factors for amputation in a highly complex reference service.

DESCRIPTORS: Traffic-Accidents; Amputation; Traumatology.

RESUMEN

Objetivo: Analizar los factores de riesgo de amputación traumática en víctimas de accidentes de tráfico. **Metodología:** Se trata de un estudio epidemiológico, retrospectivo, descriptivo y analítico, con abordaje cuantitativo, realizado en un hospital cuaternario de referencia en trauma, en la ciudad de Recife-PE. La población estuvo compuesta por individuos que fueron víctimas de accidentes de tránsito, hospitalizados en el sector de traumatología de adultos y que fueron sometidos a cirugía de amputación. La muestra no probabilística, por conveniencia, estuvo constituida por 70 pacientes que fueron sometidos a cirugía de amputación durante el período de julio de 2014 a junio de 2018. **Resultados:** La mayoría eran hombres (82,9%); en el grupo de edad de 18 a 39 años (62,9%); soltero (60%), el tipo de accidente más frecuente fue una caída de motocicleta con un 34,3%; El 60% eran conductores y el 27,1% peatones; El 11,4% no utilizó equipo de seguridad; y 11,4% alcohol usado. Las lesiones más frecuentes correspondieron a lesiones múltiples (48,6%); El 42,8% fueron hospitalizados menos de 30 días (42,8%); El 14,3% ingresó en la UCI y permaneció de 1 a 84 días; el tipo de amputación más frecuente (57,1%) fue transfemoral, 27,1% transtibial y el 15,7% restante fue de otro tipo. **Conclusión:** Los hallazgos del estudio sobre los factores de riesgo de amputación traumática no mostraron una asociación significativa, pero contribuyen a investigar los factores de riesgo de amputación en un servicio de referencia de alta complejidad.

DESCRIPTORES: Accidentes de Tráfico; Amputación; Traumatología.

RESUMO

Objetivo: Analisar os fatores de risco para amputação traumática em vítimas de acidentes de trânsito. **Metodologia:** Trata-se de um estudo epidemiológico, retrospectivo, descritivo e analítico, com abordagem quantitativa, realizado num hospital quaternário de referência em traumas, na cidade de Recife-PE. A população foi composta por indivíduos vítimas de acidentes de trânsito, internadas no setor de traumatologia adulto e submetidos à cirurgia de amputação. A amostra não probabilística, por conveniência foi composta por 70 pacientes submetidos à cirurgia de amputação durante o período de julho de 2014 a junho de 2018. **Resultados:** A maioria era do sexo masculino (82,9%); na faixa etária de 18 a 39 anos (62,9%); solteiro (60%), o tipo de acidente mais frequente foi a queda de moto com 34,3%; 60% era o condutor e 27,1% pedestre; 11,4% não utilizava equipamento de segurança; e 11,4% fizeram uso de bebida alcoólica. As lesões de natureza mais frequente corresponderam a traumatismos múltiplos (48,6%); 42,8% ficaram internados menos de 30 dias (42,8%); 14,3% foram internados na UTI e permaneceram de 1 a 84 dias; o tipo de amputação mais frequente (57,1%) foi a transfemoral, 27,1% transtibial e os demais 15,7% foram de outros tipos. **Conclusão:** Os achados do estudo no que concerne aos fatores de risco para amputação traumática não mostraram associação significativa, mas contribuem para investigar os fatores de risco para amputação em um serviço de referência de alta complexidade.

DESCRIPTORES: Acidentes de Trânsito; Amputação; Traumatologia.

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Felipe Carvalho Farias

Nurse. Government of the State of Pernambuco, Recife, PE.
ORCID: 0000-0002-7867-1037

Tarcísia Domingos de Araújo Sousa

Master' student in Nursing. University of Pernambuco - UPE, Recife, PE.
ORCID: 0000-0002-9274-6154

Jéssica Emanuela Mendes Morato

Master' student in Nursing. University of Pernambuco - UPE, Recife, PE.
ORCID: 0000-0002-0852-9676

Maria Sonja Oliveira de Oliveira

Nurse. Faculty of Human Sciences of Olinda - FACHO, Olinda, PE.
ORCID: 0000-0001-6063-1160

Roberto Bezerra da Silva

Doctor in Intensive Care. Pernambuco Cancer Hospital - HCP, Recife, PE.
ORCID: 0000-0002-3528-3069

Fernanda da Mata Vasconcelos Silva

Doctoral student in Nursing. University of Pernambuco - UPE, Recife, PE.
ORCID: 0000-0001-5465-9714

Emanuela Batista Ferreira e Pereira

Doctor in Surgery. University of Pernambuco - UPE, Recife, PE.
ORCID: 0000-0003-4665-4379

INTRODUCTION

Traffic accidents represent one of the main causes of unnatural death and a reality present in many social groups, standing out as a serious public health problem, especially in underdeveloped or developing countries. They affect the younger and more productive age groups of the population more frequently, generating enormous economic, social and emotional repercussions^(1,2).

According to estimates by the World Health Organization (WHO), each year, the lives of approximately 1.35 million people are interrupted due to a traffic accident. Between 20 and 50 million people suffer non-fatal injuries, many of them resulting in disability. And as if the cost of this immense suffering were not enough, countries still lose one to two percent of their wealth with expenses related to these accidents^(1,3).

Brazil has one of the most dangerous transits in the world. In 2011, traffic accidents were responsible for 43,256 deaths in the country, of which 35,581 (82.2%) were

men and 7,649 (17.7%), women, with a mortality rate equivalent to 22.5 deaths per 100,000 population. Regarding morbidity, according to data from DATASUS 2016, in 2012, there were a total of 159,216 hospitalizations due to traffic accidents^(4,5).

Numerous factors can contribute to the increase in traffic accidents. These factors involve man; the vehicle; the road and the environment; and those related to legislation and its compliance⁽⁶⁾.

To better understand the distribution of accidents in Brazil, Minayo and collaborators⁽⁶⁾ highlight the importance of assessing the specific characteristics of the country's development, such as accelerated urbanization, which contributed to the movement of a large population to peripheral urban areas, without road infrastructure and adequate public transport, dependent on motorized transport as the only alternative for urban mobility⁽⁷⁾.

Other factors must also be considered, such as accelerated rhythms of life and work, in addition to social phenomena such as the use of alcohol and other drugs⁽⁸⁾.

In addition, another important aspect is the lack of investment in public transport, coupled with policies to encourage the production and purchase of motor vehicles and great social inequality, which has led people with higher incomes to choose to purchase cars, whereas, for those with lower income, the choice for the motorcycle stood out⁽⁷⁾.

Among the vehicles, the motorcycle has stood out as the one most involved in traffic accidents in Brazil. The motorcycle has been increasingly used by an important part of the population, due to the ease of purchase associated with lower fuel consumption and low maintenance costs^(9,10).

In addition, the motorcycle is considered as the main alternative for users who want greater agility and mobility in a context marked by congestion and the pressure of time⁽¹¹⁾.

Thus, in addition to expressive rates, such accidents are of great relevance due to the severity of injuries, promoting various types of trauma that require trau-

-matic amputations, affecting the quality of life and productivity of victims⁽¹²⁾.

Although in a lower proportion of occurrence, traumatic amputation is a fact of great concern, in addition to being associated with the greater severity of the victim, due to the risk of bleeding, shock and infection, it is directly related to the impairment of autonomy and self-esteem, causing impotence and dependence of the individual⁽¹³⁾.

It is important to emphasize that traumatic amputation should always be seen within a general context of treatment and not as its only part, whose purpose is to provide an improvement in the patient's quality of life⁽¹⁴⁾.

Investigating the risk factors associated with amputation in victims of traffic accidents is important for the formulation of public policies that promote the pre-vention of accidents and their consequences, in addition to assisting in actions aimed at reducing the impacts caused by these violent events in the lives of victims and their families. And it can also contribute to evaluate the organization of health services, especially for the assistance of a referral hospital in trauma.

Thus, the present study aims to analyze the risk factors for amputation in patients who are victims of traffic accidents seen at a trauma referral hospital.

METHODOLOGY

This is an epidemiological, retrospective, descriptive and analytical study, with a quantitative approach. Held in a quaternary hospital, a reference in trauma, located in the city of Recife, capital of the state of Pernambuco, in northeastern Brazil, with a population of 1,625,583 inhabitants and an area of 218,435 km² of territorial extension⁽¹⁵⁾.

The population was composed of individuals victims of traffic accidents, hospitalized in the adult traumatology sector, who underwent amputation surgery. The non-probabilistic convenience sample consisted of 70 patients who underwent amputation surgery during the period

from July 2014 to June 2018.

The research included victims of traffic accidents, seen at that hospital, who were admitted to the adult trauma ward, and who underwent traumatic amputation surgery and resided in the State of Pernambuco. And individuals whose medical records had incomplete or illegible information were excluded.

After the approval of the project by the Research Ethics Committee (CEP) under the number 2,628,279, data collection started from the identification of patients through the scheduling records files at the traumatology service; then, the medical records of these patients were located at the Medical Filing Service (SAME).

A semi-structured form was used in which the victim's sociodemographic and clinical data, diagnosis of injuries, date of admission and information about the surgical procedure performed at the hospital were addressed.

The variables used in the study were related to victims, traffic accidents and hospital care. The dependent variable in this study was the type of traumatic amputation performed. The independent variables related to the victims: age, age group, residence, sex and marital status; those related to traffic accidents: type of accident, position in the vehicle, the use of safety devices, use of alcohol and the nature of the injury; and those related to hospital care: type of admission to the service, length of hospital stay, ICU stay, time between the accident and arrival at the hospital, the indication for amputation and the outcome of the case.

At the end of the data collection, a review of the data was carried out to check for the possible existence of inconsistencies and / or gaps in filling out the instruments. After the review, the data were encoded and inserted into a Microsoft Excel® spreadsheet. The data were analyzed descriptively through absolute and percentage frequencies for the categorical variables and the measures: mean, standard deviation and median of the age variable. Pearson's chi-square test or

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Fisher's exact test was used to assess the association between two categorical variables when the condition for using the chi-square test was not verified. The margin of error used in deciding the statistical tests was 5%.

The data were entered into the Microsoft Excel® spreadsheet and the pro-gram used to obtain the statistical calculations was IMB SPSS in version 23.

This study was approved by the Ethics Committee (CAAE: 87370618.2.0000.5198) and is in accordance with Resolution No. 466/12 of the National Health Council⁽¹⁶⁾. The principles of bioethics were respected, as well

as the confidentiality and anonymity of the research subjects, described in the Confidentiality Term. The waiver of the Informed Consent Form was requested, as it is a research with data from medical records. As well, the hospital's consent and authorization from the Traumatology and SAME sector were requested.

RESULTS

Initially, 116 patients who were hospitalized between January 2011 and June 2018 in the orthopedics and traumatology sector were included in the re-search; and had previously scheduled traumatic

amputation surgery. Of these, 46 were excluded from the research because they had not suffered a traffic accident or because the surgery was canceled. The final sample of the research had a total of 70 patients who were amputated after injuries resulting from traffic accidents.

The age of the research participants ranged from 16 to 79 years old, with an average of 36.11 years; with a standard deviation of 14.87 years; and median of 33.50 years.

Table 1 presents the results related to the characteristics of the sample, where it is highlighted that the two highest percentages corresponded to the age groups of 18 to 29 years and 30 to 39 years with percentages of 32.9% and 30.0%, respectively, and the other age groups had percentages ranging from 5.7% to 12.9%; the majority were male (82.9%); 60% were single, followed by 37.1% married and for 2.9% information about the marital situation was absent; the highest percentage (40.0%) was resident in Geres I, followed by Geres IV (18.6%) and Geres V (11.4%) and the other Geres had percentages ranging from 1.4% to 8.6%.

From the results contained in Table 2, it is emphasized that: the highest percentage corresponded to patients who had between 03 and 04 hours between the accident and the arrival at the hospital for care, with 37.1% of the group, the lowest corresponded to less than one hour (7.1%) and the percentages of the other two time bands ranged from 17.1% to 20.0%; the most frequent types of accidents were motorcycle crash, motorcycle x car collision and being run over with respective percentages: 34.3%, 28.6% and 27.1%; in relation to the position in the vehicle, 60.0% corresponded to a driver, 27.1% were pedestrians and the remaining 12.9% were passengers; more than half (54.3%) had no information on the use of a safety device, for pedestrians this question does not apply, 11.4% did not use the equipment at the time of the accident and only 7.1% used it; the percentage of individuals who used alcohol was 11.4%.

Table 1. Characteristics of the total sample. Recife, PE, Brazil, 2019

Variável	n	%
TOTAL	70	100,0
Faixa etária		
< 18	4	5,7
18 a 29	23	32,9
30 a 39	21	30,0
40 a 49	7	10,0
50 a 59	9	12,9
60 ou mais	6	8,6
Sexo		
Masculino	58	82,9
Feminino	12	17,1
Situação conjugal		
Solteiro	42	60,0
Casado	26	37,1
Não informado	2	2,9
Residência		
Geres I	28	40,0
Geres II	6	8,6
Geres III	1	1,4
Geres IV	13	18,6
Geres V	8	11,4
Geres VI	1	1,4
Geres X	2	2,9
Geres XI	4	5,7
Geres XII	6	8,6
Não informado	1	1,4

Table 2. Evaluation of data related to the accident, entry and exit of the health unit. Recife, PE, Brazil, 2019

Variável	n	%
TOTAL	70	100,0
Tempo entre chegada ao hospital e atendimento (horas)		
< 1h	5	7,1
1 a 2h	12	17,1
2 a 3h	13	18,6
3 a 4h	26	37,1
> 4h	14	20,0
Tipo de acidente		
Queda de moto	24	34,3
Colisão Moto x Carro	20	28,6
Atropelamento	19	27,1
Capotamento	2	2,9
Colisão Moto x Objeto fixo	3	4,3
Colisão Moto x Ônibus	2	2,9
Posição no veículo		
Carona	9	12,9
Condutor	42	60,0
Pedestre	19	27,1
Uso de dispositivo de segurança		
Sim	5	7,1
Não	8	11,4
Pedestre	19	27,1
Não informado	38	54,3
Uso de álcool		
Sim	8	11,4
Não	62	88,6
Tipo de entrada		
SAMU	17	24,3
CBM	6	8,6
Transferência	45	64,3
Demanda espontânea	2	2,9
Natureza da lesão		
Traumatismos múltiplos	34	48,6
Fratura de MMSS	1	1,4
Fratura de MMII	32	45,7
Esmagamento de MMII	3	4,3
Tempo de internamento (dias)		
< 30 dias	30	42,8
30 a 60	20	28,6

The most frequent type of hospital admission was through the transfer of other services (64.3%), followed by 24.3% brought by SAMU; the most frequent injuries corresponded to: multiple trauma and lower limb fracture with 48.6% and 45.7%, respectively; the highest percentage frequency corresponded to those who were hospitalized less than 30 days (42.8%) and the percentages of those who remained 30 to 60 days and more than 60 days hospitalized were exactly equal to 28.6%; the majority (85.7%) did not require ICU admission and the remaining 14.3% who were admitted to the ICU remained in that unit from 1 to 84 days.

The main types of amputation were transfemoral (57.1%) and transtibial (27.1%), adding together a total of 84.2% of all amputations in which the participants in this study were submitted; amputations of upper limbs, fingers, feet and toes, due to their very low incidence, were grouped as other amputations (15.7%).

The time between attendance and surgery was less than 24 hours for half of the sample and the time ranges of 24 to 96 hours and more than 96 hours had percentages of 20.0% and 30.0% respectively; with the exception of two patients, all the others (97.1%) needed reoperation; and in relation to the outcome of the case, with the exception of one case of death, all the others were discharged from the hospital.

Table 3 analyzes the type of amputation according to the variables of the demographic profile and, in Table 4, with the clinical variables.

For the fixed margin of error (5%), no significant associations were found ($p > 0.05$) between the type of amputation and the variables of the demographic profile.

In Table 4, the type of amputation was evaluated according to the time between arrival at the health unit, type of accident, position in which he was, time between care until surgery, use of alcohol, length of stay and ICU stay, and there were no

> 60	20	28,6
Internamento em UTI		
Não	60	85,7
Sim	10	14,3
Tipo de amputação		
Transfemoral	40	57,1
Transtibial	19	27,1
Outro tipo	11	15,7
Tempo entre atendimento até a cirurgia (horas)		
Menos de 24	35	50,0
24 a 96	14	20,0
Mais de 96	21	30,0
Necessidade de reoperação		
Sim	68	97,1
Não	2	2,9
Desfecho		
Alta hospitalar	69	98,6
Óbito	1	1,4

being, causing an impact on physical, psychological, family, social and / or financial aspects. And in 2017, the State of Pernambuco registered, according to DATASUS(17), a total of 2,915 lower limb amputations.

Evidence also points out that if no action is taken to reverse this scenario, it is estimated that in mid-2020, traffic deaths could reach 1.9 million people world-wide and could become the 5th leading cause of mortality by 2030⁽¹⁸⁾.

Despite the consensus in pointing out that the main determining factor for amputation is due to clinical causes, with emphasis on complications resulting from Diabetes Mellitus, it should be noted that amputations due to external causes are one of the most growing reasons related to amputation, where the portion youngest of the population is the most affected and with a predominance of males⁽¹⁹⁾.

These results corroborate with those of this research, where there was an emphasis on male individuals, characterized by young men, leading to a great socio-economic loss, considering that such population is economically active.

Most of the victims in this study were single, differing from others in the country(20-23). Almeida and collaborators⁽⁶⁾ claim that singles are more susceptible to accidents than married people because the former are more exposed to risks. The prevalence of the youngest age group occurs due to lack of experience in driving the vehicle, search for emotions, pleasure in experiencing sensations of risk, impulsivity and alcohol or drug abuse⁽²²⁾.

The post-amputation process requires a number of adaptations from the individual, with social support as the main source of support, which is obtained through the network of relationships. After the amputation, it is expected that the person will be reinserted in society and the strengthening of this ideal is achieved with the realization of rehabilitation, as becoming dependent is one of the reasons for the amputee's concern. A high number of

Table 3. Evaluation of the type of amputation according to the demographic profile. Recife, PE., Brazil, 2019

Variável	Tipo de amputação								Valor de p
	Transfemoral		Transtibial		Outro		TOTAL		
	n	%	n	%	n	%	n	%	
Faixa etária									p(1) = 0,687
20 a 29	18	66,7	6	22,2	3	11,1	27	100,0	
30 a 39	11	52,4	7	33,3	3	14,3	21	100,0	
40 ou mais	11	50,0	6	27,3	5	22,7	22	100,0	
Grupo Total	40	57,1	19	27,1	11	15,7	70	100,0	
Sexo									p(1) = 0,131
Masculino	36	62,1	14	24,1	8	13,8	58	100,0	
Feminino	4	33,3	5	41,7	3	25,0	12	100,0	
Grupo Total	40	57,1	19	27,1	11	15,7	70	100,0	
Situação conjugal									p(2) = 0,163
Solteiro	25	59,5	13	31,0	4	9,5	42	100,0	
Casado/União estável	13	50,0	6	23,1	7	26,9	26	100,0	
Grupo Total	38	55,9	19	27,9	11	16,2	68	100,0	

(1) Using Fisher's exact test (2) Using Pearson's chi-square test.

significant associations ($p > 0.05$) between the type of amputation and the variables presented.

DISCUSSION

Traffic accidents generate consequences in all aspects that affect the human

Table 4. Risk factors for amputation. Recife, PE, Brazil, 2019

Variável	Tipo de amputação								Valor de p
	Transfemorais		Transtibiais		Outro		TOTAL		
	n	%	n	%	n	%	n	%	
Grupo Total	40	57,1	19	27,1	11	15,7	70	100,0	
Tempo entre a chegada ao hospital e atendimento (horas)									p(1) = 0,733
Até 1	7	41,2	7	41,2	3	17,6	17	100,0	
2	7	53,8	3	23,1	3	23,1	13	100,0	
3	17	65,4	6	23,1	3	11,5	26	100,0	
4 ou mais	9	64,3	3	21,4	2	14,3	14	100,0	
Tipo de acidente									p(1) = 0,334
Queda de moto	17	70,8	5	20,8	2	8,3	24	100,0	
Atropelamento	12	60,0	6	30,0	2	10,0	20	100,0	
Moto + Carro	9	47,4	5	26,3	5	26,3	19	100,0	
Outro	2	28,6	3	42,9	2	28,6	7	100,0	
Posição em que se encontrava									p(1) = 0,897
Carona	4	44,4	3	33,3	2	22,2	9	100,0	
Condutor	25	59,5	11	26,2	6	14,3	42	100,0	
Pedestre	11	57,9	5	26,3	3	15,8	19	100,0	
Tempo entre atendimento até a cirurgia									p(1) = 0,102
Menos de 24h	20	57,1	7	20,0	8	22,9	35	100,0	
24h a 96h	7	50,0	4	28,6	3	21,4	14	100,0	
Mais de 96h	13	61,9	8	38,1	-	-	21	100,0	
Uso de álcool									p(1) = 0,869
Sim	4	50,0	3	37,5	1	12,5	8	100,0	
Não	36	58,1	16	25,8	10	16,1	62	100,0	
Tempo de internamento (dias)									p(1) = 0,941
< 30 dias	16	53,3	8	26,7	6	20,0	30	100,0	
30 a 60	12	60,0	6	30,0	2	10,0	20	100,0	
> 60	12	60,0	5	25,0	3	15,0	20	100,0	
Permanência em UTI									p(1) = 0,360
Sim	5	50,0	2	20,0	3	30,0	10	100,0	
Não	35	58,3	17	28,3	8	13,3	60	100,0	

(1) Through Fisher's exact test.

lower limb amputations is observed, which corroborates national and international studies^(19,24-27).

As for the main types of amputation, the results of this study converge with those of other studies, such as that carried out by Chamlian⁽²⁸⁾, where these types of amputation accounted for 87.6% of the total sample; and Reis, Casa Júnior and

Campos⁽²⁹⁾, in which transfemoral and transtibial amputations totaled 74.12%.

As for hospitalization, it was observed that most victims remained less than 30 days in hospital in the traumatology and orthopedics sector, corroborating the study carried out in the United States by Inkellis and collaborators⁽³⁰⁾, where the participants had an average hospital stay

of 17 days. However, it is worth mentioning that 97.1% of the participants needed a surgical approach, which refers to the fact of the severity of the injuries, which may also take into account the poor evolution of the wound in the postoperative period.

It was also observed that some participants of the research remained between

01 to 84 days hospitalized in the Intensive Care Unit (ICU), which is worth highlighting the high cost that this patient can cause for the State, as mentioned by Zuliani and collaborators⁽³¹⁾ in their study on consumption and cost of resources in the ICU.

This fact refers to the importance of the quality of care offered to trauma victims, because injuries that affect the skeletal muscle system usually demand the need for care and require therapeutic measures in a timely manner, since the lack of assistance or inadequate care can result in functional impairment, temporary or even permanent, with direct effects on the daily and work activities of the victims⁽³²⁾.

There was a predominance of admission to the service by means of hospital transfer, where it probably came from less complex services, but it is worth highlighting the importance of pre-hospital service, since most of them were admitted to the service through the Mobile Emergency Service (SAMU) and Military Fire Brigade of Pernambuco.

It is essential that health care for motorcyclists who are victims of traffic accidents is consistent and works in an integrated manner, from pre-hospital care to post-hospital care. The assistance provided by SAMU at the accident site in a timely manner, with qualified professionals, makes it possible to reduce the aggravation of injuries until they arrive in the hospital environment.

And on arrival at the referral hospital, recovery and minimization procedures for these injuries must be carried out, as is the case with surgical procedures. For this purpose, hospitals must have a competent multidisciplinary team and specialized equipment, with the purpose of providing better care for your patients.

It is important to highlight the need that these individuals have for quality care, also, after hospital discharge, and it is essential that health services are prepared and engaged to meet this demand, in order to promote a good physical, psychological and social rehabilitation.

CONCLUSION

The study's findings, regarding the risk factors for traumatic amputation, did not show any significant association, but they contribute to investigate the risk factors for amputation in a highly complex reference service.

With the characterization of the sociodemographic profile of victims of traffic accidents who are subjected to traumatic amputation and with the identification of risk factors for this affection, it is expected that more specific and effective pre-ventive actions are formulated in order to avoid physical damage, social and financial benefits for victims, society and public coffers.

The main limitations of this study were the lack of sufficient records of all patients who were amputated and the limited availability of studies on the topic addressed.

The healthcare service network must be articulated and made up of competent professionals who are attentive to the particularities of victims who have undergone traumatic amputation. ■

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