

# Epidemiological profile of surgical ankle and foot injuries caused by motorcycle accidents attended at a state emergency hospital in Bahia

Perfil epidemiológico das lesões cirúrgicas de tornozelo e pé causadas por acidente motociclístico atendidas em um hospital estadual de emergência na Bahia

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## ABSTRACT

**Objective:** To qualify and quantify ankle and foot injuries requiring emergency surgery, and to describe the profile of patients attended at the HGE with these injuries, emphasizing the importance of the presence of the specialist traumatologist in this sector. **Method:** This is a transversal, individualized, observational study of the case survey type, of patients who were attended at the largest state emergency hospital in Bahia following traffic accidents. Patient records from 10/28/2015 to 04/28/2016 were analyzed. **Results:** Of the 2718 emergency surgeries performed covering all the medical specialties, 244 (8.97%) were orthopedic surgeries to the ankle and foot following motorcycle accidents. The distribution of victims by sex showed a predominance of males (86.47%). The predominant age range was 32-41 years (27.45%), followed by individuals aged from 22-31 years (25.40%). The most prevalent lesions was exposed fracture of the toe (40.57%), the most common toe fracture being to the hallux (38.38%) followed by exposed fracture of the 5<sup>th</sup> toe (33.33%). The right side was the most affected. **Conclusion:** Ankle and foot injuries requiring emergency treatment following motorcycle accidents are very prevalent, comprising 8.97% of emergency surgeries in the period studied, which corresponds to 27.05% of the total orthopedic trauma

## RESUMO

**Objetivo:** Qualificar e quantificar as lesões cirúrgicas de urgência do tornozelo e pé, além de descrever o perfil de pacientes atendidos no HGE com essas lesões, ressaltando a importância da presença do traumatologista especialista nesse segmento. **Método:** Trata-se de um estudo transversal, individuado observacional, do tipo levantamento de casos, de pacientes que foram atendidos por acidentes de trânsito no maior hospital estadual de emergência na Bahia. Foram analisados prontuários entre 28/10/2015 a 28/04/2016. **Resultados:** Das 2718 cirurgias de urgência realizadas abrangendo todas as especialidades médicas, 244 (8,97%) foram cirurgias ortopédicas ao nível do tornozelo e pé secundárias a acidentes de motocicleta. A distribuição das vítimas conforme o gênero revela a predominância do sexo masculino (86,47%). A faixa etária dominante foi de 32-41 anos (27,45%), seguida de indivíduos com idade entre 22-31 anos (25,40%). A lesão mais prevalente foi fratura exposta de pododáctilo (PD) (40,57%), sendo fratura do hálux a mais comum dentre as fraturas de PD (38,38%), seguido por fratura exposta do 5º PD (33,33%). O lado direito foi o mais acometido. **Conclusão:** As lesões ao nível do tornozelo e pé que necessitam de tratamento cirúrgico de urgência secundário a acidente motociclístico mostram-se bastante

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surgeries. The majority affected are male, with toe injuries being the most common.

#### Keywords:

Fractures, bone/epidemiology; Foot bones/injuries; Ankle/injuries; Foot bones/epidemiology; Ankle/epidemiology

## INTRODUCTION

Traffic accidents (TAs) are among the main causes of death in the world. More than 41 thousand road traffic deaths were recorded in Brazil in 2013, even though it is the country that applies risk control laws most often, thus topping the South American per capita ranking<sup>(1)</sup>.

In 1997, the Brazilian Traffic Code (CTB), created by Law No. 9,503, was approved, giving rise to a range of changes aimed at facing the peak of violence that had been growing exponentially since the early 1990s<sup>(2)</sup>.

Although the new law came into force in the 1990s, there were still reports of increases in mortality, which were more pronounced among the young population. In this period, rates of youths (between 15 and 29 years old) increased by 26.6%, versus 20.3% of the rest of the population<sup>(3)</sup>. Between 1997 and 2000, there was a significant downturn, particularly in 1998 (initial year of validity) when the decrease was above 13%. In the following years, decreases were lower, 2% per year, on average<sup>(3)</sup>. From the year 2000, the rates resumed their growth, almost hitting a plateau. However, in 2004, the indicators returned to the level of 1997, and grew constantly thereafter. Between 2000 and 2007, rates of traffic accidents involving youths grew by 27.4% and were much higher than the rates of the rest of the population, which grew by 11.1%<sup>(3)</sup>.

The northern and northeastern regions had the highest rates of growth in deaths due to traffic accidents, with increases of 64.8% and 76.0%, respectively<sup>(3)</sup>.

According to data collected by the Brazilian Ministry of Health and DPVAT (compulsory limited third party insurance cover) referring to national traffic accident statistics, in 2014 alone, there were 43,075 deaths and 201,000 hospitalized victims, with a total of 52,200 death and 596,000 disability indemnity payouts<sup>(4)</sup>.

It can be noted that traffic accidents imply high costs for society. Analyzing the year 2014 alone, accidents on federal highways in Brazil totaled R\$ 12 billion in social costs. According to the Institute for Applied Economic Research

prevalentes, totalizando 8,97% das cirurgias de urgência no período estudado, número que corresponde a 27,05% das cirurgias totais do trauma ortopédico. A grande maioria acomete o sexo masculino, sendo as lesões de PD as mais frequentes.

#### Descritores:

Fraturas ósseas/epidemiologia; Ossos do pé/lesões; Tornozelo/lesões; Ossos do pé/epidemiologia; Tornozelo/epidemiologia

(IPEA), a fatal accident generates an average cost of R\$ 647 thousand, while the average cost involved in an accident with a victim is R\$ 90 thousand. Accidents without victims come to R\$ 23 thousand. In 2005, accidents classified by the Highway Police as accidents without victims had an average standard cost of R\$ 16,840 per accident<sup>(5)</sup>.

Motorcycle accident indemnity payouts correspond to 76% of the amount paid in 2015. Accidents caused by motorcycles generated some type of permanent disability in 83% of cases, 4% led to death and 13% resulted in reimbursement of hospital expenses. By comparison, automobiles amount to 19% (124,267) of indemnities paid, while trucks and pick-ups amount to 3% (17,973) and buses, minibuses and vans 2% (13,100)<sup>(5)</sup>. Of the total indemnity payouts (652,349), 64% were made to drivers, 18% to pedestrians and 18% to passengers. The survey by Seguradora Líder (Lead Insurer)-DPVAT also reveals that 74% of traffic accident victims indemnified in 2015 are male and between 18 and 34 years old<sup>(6)</sup>.

Epidemiology, especially in situations involving the need for better adaptation of hospital infrastructures, is essential in understanding the demand of patients who have suffered accidents. Unfortunately, studies with an epidemiological survey similar to the one presented here are scarce in the national literature.

Based on national statistics, a qualitative and quantitative study is needed along with a description of the profile of patients admitted to the Hospital Geral do Estado da Bahia (General Hospital of the State of Bahia) with foot and ankle injuries requiring emergency surgery, emphasizing the importance of the presence of the trauma specialist in this segment.

## METHODS

This is a cross-sectional study, individuated observational study, through indirect observation, of the case-finding type, of patients who underwent emergency surgical treatment at the HGE. The policy of this hospital is to perform

emergency surgery only on open fractures, while closed fracture cases are hospitalized and monitored. The data were collected at the actual hospital, in the medical and statistical archive department (SAME).

The sample group was made up of all the medical records of patients who were victims of motorcycle accidents at the HGE, regardless of age or sex. Records were analyzed between 10/28/2015 and 4/28/2016.

Data were collected by a single examiner. The following variables were analyzed: age, sex, laterality, type of injury. All the injuries were supposed to contain joint exposure or open fracture, since they were emergency surgeries.

A total of 2718 files were analyzed in this study. The inclusion criterion was patients with injuries requiring emergency surgery secondary to motorcycle accidents. Subjects who did not meet the above criterion were excluded from the study.

As dictated by Resolution 196/96, this study is duly registered with SISNEP (National System of Information on Ethics in Research Involving Human Subjects) (CAAE - Certificado de Apresentação para Apreciação Ética [Ethics Evaluation Submission Certificate] - 62570116.5.0000.5520) and was approved by the Institutional Review Board of Santa Casa da Bahia – Hospital Santa Izabel.

## RESULTS

Based on information from the surgery register of our hospital, it is possible to assess the epidemiological characteristics of surgeries performed between October 2015 and April 2016. Of the 2718 emergency surgeries performed at the HGE covering all medical specialties (orthopedics, general surgery, neurosurgery, urology, plastic surgery, pediatric surgery, otorhinolaryngology and ophthalmology), 902 (33.18%) were orthopedic trauma surgeries. Of these, 244 (8.97%) were orthopedic surgeries on the foot and ankle secondary to motorcycle accidents, a figure that corresponds to 27.05% of total orthopedic trauma surgeries.

Of these 244 surgeries, 211 (86.47%) were performed on male patients and 33 (13.53%) on female patients. When separated by age group, the dominant age group was composed of individuals aged between 32 and 41 years (27.45%), followed closely by individuals aged between 22 and 31 years (25.40%), between 12 and 21 years (22.13%), 42 and 51 years (10.24%), 52 and 61 years (7.37%), 02 and 11 years (4.09%), and over 62 years (3.27%) (Table 1).

According to the preoperative diagnoses, ten types of injury were found: traumatic amputation of toes, open me-

**Table 1** | Distribution by age group and by sex

Age group	Sex	
	Male	Female
02-11 years	9	1
12-21 years	48	6
22-31 years	53	9
32-41 years	58	9
42-51 years	23	2
52-61 years	14	4
62-71 years	2	0
72 years or over	4	2
<b>TOTAL</b>	211	33

tatarsal (MT), toe, calcaneal, talus, and ankle fractures, Lisfranc fracture-dislocation, open dislocation of toes, open extensor tendon rupture and calcaneal tendon rupture (Table 2).

The most prevalent injury was open toe fracture with 99 procedures or 40.57% of the total surgeries, followed by open ankle fracture with 32 (13.11%), open MT fracture and traumatic amputation of toes with 28 each (11.47%), and open extensor tendon rupture with 25 (10.24%) surgeries respectively. The remaining injuries were found in smaller proportions, with open dislocation of toes accounting for 4.91%, open calcaneal tendon rupture for 3.27%, and open calcaneal fracture for 2.86%. Open talus fracture and Lisfranc fracture-dislocation obtained the same proportion of 0.81% and there was only one surgery on combined fracture of the talus and calcaneus (0.40%).

Among all the injuries observed, only calcaneal fracture was more prevalent in the female patients (57.14%), while male patients predominated in the other injuries (Table 2).

In Table 2, when we evaluate laterality, it can be noted that the right side was the most affected in Lisfranc fracture-dislocation (100%), followed by open calcaneal fracture (85.71%), open extensor tendon rupture (72%), amputation (71.42%), open calcaneal tendon rupture (62.5%), and open toe fracture (54.54%). The left side was affected more often in open talus fracture and in combined fracture of the talus and calcaneus (100%), followed by open ankle fracture (65.62%), open MT fracture (64.28%), and open toe dislocation (58.33%).

In detailing some of the injuries found, it is possible to qualify them more accurately.

Regarding traumatic amputation of toes, it can be noted that the most prevalent was that of the 5<sup>th</sup> toe with 11

**Table 2** | Types of injuries to the foot and ankle by laterality and sex

Injuries	No. of patients	Laterality		Sex	
		Right	Left	Male	Female
Traumatic amputation of toes	28	20	8	25	3
Open MT fracture	28	10	18	25	3
Open toe fracture	99	54	45	89	10
Open calcaneal fracture	7	6	1	3	4
Open talus fracture	2	0	2	2	0
Open fracture of calcaneus and talus	1	0	1	1	0
Open ankle fracture	32	11	21	24	8
Lisfranc fracture-dislocation	2	2	0	2	0
Open toe dislocation	12	5	7	10	2
Open extensor tendon rupture	25	18	7	23	2
Open calcaneal tendon rupture	8	5	3	7	1
<b>TOTAL</b>	<b>244</b>	<b>131</b>	<b>113</b>	<b>211</b>	<b>33</b>

(39.28%) procedures performed, followed by amputation of the 3<sup>rd</sup> toe with 8 (28.57%), while the 4<sup>th</sup> toe and the hallux obtained the same number of 6 (21.42%) surgeries each. Among these, five procedures involved amputation of multiple toes (Table 3).

**Table 3** | Site of injury by type

Site of Injury	Type of injury		
	Traumatic amputation	MT fracture	Toe fracture
1 <sup>st</sup> toe	6	2	38
2 <sup>nd</sup> toe	5	12	14
3 <sup>rd</sup> toe	8	6	16
4 <sup>th</sup> toe	6	8	20
1 <sup>st</sup> toe	11	17	33
Multiple toes	5	15	29
<b>TOTAL</b>	<b>41</b>	<b>60</b>	<b>150</b>

Regarding open MT fractures, the most common injury was open fracture of the 5<sup>th</sup> metatarsal bone present in 17 (60.71%) surgeries, followed by injury to the 2<sup>nd</sup> MT with 12 (42.85%), to the 4<sup>th</sup> MT with 8 (28.57%), the 3<sup>rd</sup> MT with 6 (21.42%), and lastly the 1<sup>st</sup> MT with 2 (7.14%) procedures, respectively. Of these, 15 involved multiple metatarsal fractures (Table 3).

Regarding open fractures of the toes, the most common in decreasing order were those of the hallux in 38 (38.38%), fractures of the 5<sup>th</sup> toe in 33 (33.33%), of the 4<sup>th</sup>

toe in 20 (20.20%), of the 3<sup>rd</sup> toe in 16 (16.16%) and of the 2<sup>nd</sup> toe in 14 (14.14%) procedures. On 29 occasions, there were multiple toe fractures (Table 3).

Of the ankle fractures, isolated lateral malleolus fracture was the most prevalent with 13 (40.62%) surgeries performed, followed by bimalleolar fracture with 9 (28.12%), fracture-dislocation with 7 (21.87%), and isolated medial malleolus fracture with 4 (12.5%) procedures (Table 4).

**Tabela 4** | Ankle injuries

Fracture site	No. of procedures
Lateral malleolus	13
Medial malleolus	9
Bimalleolar	4
Fracture-dislocation	7
<b>TOTAL</b>	<b>33</b>

## DISCUSSION

The motorcycle is currently the most popular method of individual transport in Brazil, gaining acceptance and approval because of its agility and low cost.<sup>(2)</sup> However, the riding mode and the vulnerability of both rider and passenger have contributed to the increase in accidents involving motorcyclists, particularly young males<sup>(2,7,8)</sup>.

Motorcyclists are considered the top priority group in prevention programs, with a seven times higher risk of death, a four times higher risk of bodily injury, and a two times

higher risk of colliding with a pedestrian when compared to motorists. Motorcyclists are the main victims of TAs, a position historically occupied by pedestrians<sup>(2)</sup>.

Studies that showed a reduction in TAs after the implementation of the CTB and Law no. 11,705/08 suggest that the government can reduce a considerable portion of accidents and save lives. However, it is crucial for actions to be both continuous and rigorous. Educational measures are important and widely used but are not effective, especially when used alone<sup>(2)</sup>.

According to the Ministry of Health (DATASUS), the State of Bahia recorded 2,563 deaths in traffic accidents in the year 2014<sup>(9)</sup>.

The Brazilian Institute of Geography and Statistics (IBGE) shows that Salvador recorded a population of 2,921,087 inhabitants in 2015, with a total fleet of 846,102 vehicles, of which 564,606 (66.73%) are automobiles and 117,765 (13.91%) motorcycles<sup>(10)</sup>.

HGE is the largest unit of the state health network and the main reference in urgent and emergency trauma care in Bahia, not only for patients from Salvador, but for those from across the state. In the area of trauma, most hospital admissions are due to: falls, pedestrians involved in collisions, burns, car accidents, firearm injuries, stab wounds, and others<sup>(11)</sup>.

The vast majority of patients with severe foot trauma are young, male and of working age. The injuries are caused by high-energy trauma (fall from height, car accident, motorcycle accident, pedestrian involved in collisions, crushing due to falling object or foot compression), and are frequently associated with bone exposure, major loss of soft tissue and multiple fractures and dislocations<sup>(12)</sup>.

The prevalence of male adults observed in this study follows the numbers reported in other studies on similar topics. In our study, 86.47% of the victims were men. In the study by Oliveira et al.<sup>(13)</sup>, this statistical significance was 88.86%; in the study by Pinto and Witt<sup>(14)</sup> 86.7%; and in the study by Dall'aglio,<sup>(15)</sup> 77.78% of the total set of victims. The importance of motorcycle accidents involving male victims may be related to their greater exposure, as well as the greater use of this type of vehicle<sup>(6)</sup>.

When analyzed by age group, the dominant age bracket of the surgeries recorded was composed of individuals between 32 and 41 years (27.45%). Other studies have shown the prevalence of younger patients involved in motorcycle accidents. Dall'aglio<sup>(15)</sup> demonstrated in his study that 63.89% of victims were between 15 and 40 years old. Pinto and Witt<sup>(14)</sup> demonstrated that 78.9% of victims were aged

between 18 and 35 years. Thus, the affirmations shown in these studies observe a strong relationship between an economically active and potentially contributory working class population and motorcycle accidents.

The total number of surgeries performed on ankle and foot trauma injuries was 244 over a 6-month period. This figure is similar on average to the study by Pinto and Witt<sup>(14)</sup> which found 54 extremity fractures over a one-month period in 2007. Sakata et al.<sup>(12)</sup>, in a study on the severely traumatized foot, observed a total of 14 feet involved in motorcycle accidents over a 22-year period. In all these studies, the hospital of choice was a Center of Reference for Trauma Care located in a state capital, as is ours.

The highest numbers in the distribution of the total group of fractures involving the foot and ankle can be found in open toe fracture with 99 procedures or 40.57% of the total surgeries, followed by open ankle fracture with 32 (13.11%), open MT fracture and traumatic amputation of the toes with 28 each (11.47%), and open extensor tendon rupture with 25 (10.24%) surgeries, respectively. In the study by Sakata et al.<sup>(12)</sup>, the areas most frequently affected by bone exposure were: metatarsals and phalanges in 35.36% of the extremities; calcaneus in 23.17% of the extremities; midfoot (including navicular, cuboid and wedges) in 15.85% of the extremities; and malleolar region of the ankle in 21.95% of the extremities. It is evident that, in spite of the severity of the trauma, the numbers are similar when they point to the metatarsals and phalanges as the main anatomical site injured in the foot and ankle. Open calcaneal fractures with 2.86%, open talus fractures and Lisfranc fracture-dislocations with the same proportion of 0.81%, and combined fracture of the talus and calcaneus with only 0.40%, made up the minority of procedures performed in the emergency department of our hospital. This type of injury, although less common, requires care and organized management in the first instance, greatly reducing trauma morbidity and improving functional prognosis and rehabilitation.

Our study showed a relevant prevalence of 8.97% of foot and ankle injuries requiring emergency surgical treatment secondary to motorcycle accidents (a value corresponding to 27.05% of total orthopedic trauma surgeries). Most injuries occur in male patients, and toe injuries are the most common.

## CONCLUSION

Brazil, increasingly chaotic in terms of urban mobility, lacks adaptations that allow more quality and safety for

motorcyclists and traffic users in general. Emergency services should be aware of the most prevalent situations in order to provide correct treatment for traffic accident victims. Although efforts to minimize the consequences of the accident must be continually improved, those aimed at preventing and controlling accidents, such as social welfare practice, must be prioritized.

Our study revealed that of all emergency surgeries performed at the HGE following motorcycle accidents, 8.97% were orthopedic surgeries on the foot and ankle, a number corresponding to 27.05% of the total orthopedic trauma surgeries. Most injuries occur in male patients, and toe injuries are the most common.

Therefore, qualifying and quantifying foot and ankle trauma requiring emergency surgery following motorcycle accidents, in addition to describing the profile of patients treated at the HGE with these injuries, is relevant for future studies of accident prevention, to improve medical care and traffic education actions.

## REFERENCES

1. Brasil. Nações Unidas no Brasil [Internet]. [acesso em 24 jun 2016]. Disponível em: <https://nacoesunidas.org/oms-brasil-e-o-pais-com-maior-numero-de-mortes-de-transito-por-habitante-da-america-do-sul/>
2. Bacchieri G, Barros AJD. Acidentes de trânsito no Brasil de 1998 a 2010: muitas mudanças e poucos resultados. *Rev Saúde Pública*. 2011;45(5):949-63
3. Brasil. Portal Mapa da Violência [Internet]. [Acesso em 28 jun 2016]. Disponível em [http://www.mapadaviolencia.org.br/pdf2014/Mapa2014\\_JovensBrasil\\_Preliminar.pdf](http://www.mapadaviolencia.org.br/pdf2014/Mapa2014_JovensBrasil_Preliminar.pdf)
4. Brasil. Portal Vias Seguras [Internet]. [acesso em 22 jun 2016]. Disponível em: [http://www.vias-seguras.com/os\\_acidentes/estatisticas/estatisticas\\_nacionais](http://www.vias-seguras.com/os_acidentes/estatisticas/estatisticas_nacionais)
5. Brasil. Polícia Rodoviária Federal [Internet]. [acesso em 24 mai 2016]. Disponível em: <https://www.prf.gov.br/portal/noticias/nacionais/prf-e-ipea-apresentam-relatorio-sobre-custos-sociais-em-acidentes-de-transito>
6. Brasil. EBC Agência Brasil [Internet]. [acesso em 24 mai 2016]. Disponível em: <http://agenciabrasil.ebc.com.br/geral/noticia/2016-02/indenizacoes-pagas-pelo-dpvt-registram-reducao-de-15-em-2015>
7. Cavalcanti AL, Monteiro BVB, Oliveira TBS, Ribeiro RA, BSB Monteiro. Mortalidade por acidentes de trânsito e ocorrência de fraturas maxilofaciais. *Rev Bras Odontol*. 2011;68(2):220-4
8. Miziara ID, Miziara CSMG, Rocha LE. Acidentes de Motocicletas e sua relação com o trabalho: revisão da literatura. *Saúde, Ética & Justiça*. 2014;19(2):52-9.
9. Brasil. Portal Vias Seguras [Internet]. [acesso em 21 jun 2016]. Disponível em: [viasseguras.com/os\\_acidentes/estatisticas/estatisticas\\_estaduais/estatisticas\\_de\\_acidentesnabahia](http://viasseguras.com/os_acidentes/estatisticas/estatisticas_estaduais/estatisticas_de_acidentesnabahia)
10. Brasil. IBGE - Instituto Brasileiro de Geografia e Estatística [Internet]. [acesso em 20 jun 2016]. Disponível em: <http://www.cidades.ibge.gov.br/xtras/temas.php?lang=&codmun=292740&idtema=153&search=bahia|salvador|frota-2015>
11. Bahia. Secretaria da Saúde [Internet]. [acesso em 02 jul 2016]. Disponível em: <http://www.saude.ba.gov.br/novportal/>
12. Sakata MA, Ferreira RC, Costa MT, Frizzo GG, Santin RAL. Epidemiologia do pé gravemente traumatizado. *Rev ABTPé*. 2008; 2(1):30-5.
13. Oliveira NLB, Sousa RMC. Diagnóstico de lesões e qualidade de vida de motociclistas vítimas de acidentes de trânsito. *Rev Latino-Am Enfermagem*. 2003;11(6):749-56.
14. Pinto AO, Witt RR. Gravidade de lesões e características de motociclistas atendido sem um Hospital de Pronto Socorro. *Rev Gaúch Enferm*. 2008;29(3):408-14.
15. Dall'aglio JS. Aspectos epidemiológicos dos acidentes de trânsito em Uberlândia, MG, 2000. *Biosci J*. 2010;26(3):484-90.