ORIGINAL ARTICLE
ORTHOPEDICS AND TRAUMATOLOGY
DOI: http://dx.doi.org/10.1590/1413-785220223004e245221

EPIDEMIOLOGY OF OPEN FRACTURES AND DEGREE OF SATISFACTION OF INITIAL CARE

EPIDEMIOLOGIA DAS FRATURAS EXPOSTAS E GRAU DE SATISFAÇÃO DO ATENDIMENTO INICIAL

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ABSTRACT

Introduction: Open fractures, although uncommon, with trauma have costs that exceed all other reasons for hospitalizations. Its epidemiology has fundamental importance to plan treatment and define priorities. Objective: To assess prospectively the epidemiological profile of open fractures and the degree of satisfaction with initial care. Methods: Epidemiological, prospective, descriptive, observational study was carried out in a convenience sample of open fractures. Quantitative, qualitative, and epidemiological aspects regarding open fractures were evaluated, as well as the degree of satisfaction with the initial care. Results: 124 patients treated with 155 open fractures. 88% were male; mean age 43 years (± 42.99); non-white (56.72%); married (52.41%); low level of education (51.60%); farmer, self-employed, bricklayer, industrialist (51.60%); with monthly earnings of up to 2 minimum wages (87%); healthy (76.13%); victims of labor accidents (39.51%) in bones of the hands (58.02%); 55% on the left side; attended between Thursday to Saturday (50%); work shift 6 a.m.–6 p.m. (77%). There was high level of satisfaction with the initial care provided (98%). Conclusion: Open fractures were related to healthy men, 43 years old, low education and low income, predominant in upper limbs, at 6 a.m. to 6 p.m., from Thursday to Saturday. Most were satisfied with the service provided. ***Level of Evidence II, Epidemiological, prospective, descriptive, observational study.***

Keywords: Accidents, Traffic. Epidemiology. Prospective Studies. Fractures. Open. Motorcycles.

RESUMO

Introdução: As fraturas expostas, apesar de pouco comuns, têm custos que superam todos os outros motivos das internações. Sua epidemiologia é de fundamental importância para planejar o tratamento e definir prioridades. Objetivos: Avaliar prospectivamente o perfil epidemiológico das fraturas expostas e o grau de satisfação do atendimento inicial. Métodos: Estudo epidemiológico, prospectivo, descritivo, observacional, em amostra de conveniência das fraturas expostas. Avaliaram-se aspectos epidemiológicos quantitativos e qualitativos das fraturas expostas e o grau de satisfação com o atendimento inicial. Resultados: Foram atendidos 124 pacientes com 155 fraturas expostas. Desses, 88% eram do sexo masculino com média de idade 43 anos (± 42,99); não branco (56,72%); casado (52,41%); com baixo nível de instrução (51,60%); agricultor, autônomo, pedreiro ou industriário (51,60%); com ganho mensal de até dois salários-mínimos (87%); hígidos (76,13%); vítimas de acidentes trabalhistas (39,51%) nos ossos das mãos (58,02%); especialmente do lado esquerdo (55%); atendidos entre quinta-feira e sábado (50%); no período diurno (77%). Esses pacientes mostraram elevado nível de satisfação com o atendimento inicial realizado (98%). Conclusões: As fraturas expostas se relacionaram com homens hígidos, em torno de 43 anos, baixo grau de instrução e baixa renda, nos membros superiores, no período diurno de quinta a sábado. A maioria ficou satisfeita com o atendimento prestado. ***Nível de Evidência II, Estudo Epidemiológico, Prospectivo, Descritivo e Observacional.***

Descritores: *Acidentes de Trânsito. Epidemiologia. Estudos Prospectivos. Fraturas Expostas. Motocicletas.*

Citation: Costa FC, Reis JM, Reis SP, Bartelega LA, Melo NF, Araújo CDM. Epidemiology of open fractures and degree of satisfaction of initial care. Acta Ortop Bras. [online]. 2022;30(4): Page 1 of 5. Available from URL: http://www.scielo.br/aob.

INTRODUCTION

Open fractures are uncommon and present variable occurrence, from 2.6%[1] to 23.5%[2] of fractures. In the United States, open fractures were estimated to represent an annual cost of US$ 230 million.[3] In Brazil, public spending on trauma, including open fractures, exceed all other reasons for hospitalizations.[4] Therefore, the main effect of open fractures and fractures in general is economic, because of social security costs with health and labor burdens,

All authors declare no potential conflict of interest related to this article.

The study was conducted at Hospital das Clínicas Samuel Libânio and Universidade do Vale do Sapucaí.
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Article received on 11/02/2020, approved on 04/30/2021.

as well as loss of productive capacity.[5] Open fractures are still more related to a worse prognosis than closed fractures.[6] Understanding the epidemiology of open fractures is crucially important for reference treatment centers for patients with this complex range of traumas, as this information can be used to plan treatments and define priorities.[2,6] The prognosis of patients treated in a trauma center is directly related to the quality of medical care provided, the speed such care is provided, and the established doctor-patient relationship, proven to be markers of good results in the medium- and long-term follow-up of these patients.[7] The Brazilian literature lacks of prospective studies on the incidence of open fractures and their consequent complications.[8] The socioeconomic and cultural profile of different populations influences the causes of open fractures in each region.[9] Thus, the epidemiological profile of injuries of a given region cannot be applied throughout Brazil, a large country with different realities and needs in each location. Due to the lack of epidemiological studies regarding trauma in our region, this study emerged to identify causal factors and favor targeted public policies of prevention.

METHODS

An epidemiological, prospective, descriptive, and observational study was performed on a convenience sample of open fractures treated at a regional reference university hospital (Hospital das Clínicas Samuel Libânio, Pouso Alegre, Minas Gerais). Data were collected from May 2019 to April 2020. This study was approved by the Research Ethics Committee, under protocol no. 3,345,548, on May 24, 2019. All patients agreed to participate in this study and spontaneously signed an information letter and the informed consent form.

All patients treated for open fracture were included and no restrictions were made regarding gender, fracture location, or associated injuries such as other closed fractures, vascular lesions of peripheral, abdominal, thoracic, cranial, maxillofacial, and cutaneous nerves. Excluded patients were those with initial care in other orthopedic services and later referral to our service for follow-up, death before undergoing an orthopedic surgery, evasion before hospital discharge, cognitive impairment (including caused by trauma) without legal representation, age under 18 years old, and refusal to sign the informed consent form. After receiving initial care from the trauma team and being cleared for traumatological and orthopedic treatment, all patients were subjected to an initial evaluation of the open fracture and classified, when anesthetized, according to the degree of exposure by the Gustilo-Anderson classification,[10] modified by Gustilo, Mendonza, and Williams.[11] Data were collected the day after the initial care, after the urgency. For patients who did not need to be hospitalized, the collection was made at the end of the care. Data were collected based on qualitative and quantitative demographic variables and epidemiological data related to open fractures: origin, profession, previous comorbidities, injuries associated with the trauma, trauma mechanism, distribution of open fractures regarding day, month, and time, aid providers, time until arrival at the hospital and time in the hospital until the beginning of the orthopedic treatment, established treatment, hospitalization time, and rating for the initial care. To evaluate the grade, a numerical satisfaction scale was used, classifying the care as 0–2 extremely poor, 3–4 bad, 5–6 average, 7–8 good, and 9–10 excellent. Data were tabulated in Microsoft Excel 2016 and subjected to statistical analysis. Minitab version 18.1 and Statistical Package for the Social Sciences (SPSS), Chicago, USA, version 22.0 were used.

RESULTS

A total of 124 patients and 155 open fractures were treated (20 patients with more than one open fracture), eight of which were polytraumatized. Of all patients, 109 (88%) were men and 15 (12%) were women, all aged from 18 to 101 years old. The mean age was 43 years old (± 42.99). No age group presented significant statistical difference from others, but, in absolute numbers, the group that suffered most open fractures was from 51 to 60 years old. Table 1 shows data from qualitative variables. The highest frequencies are non-whites (66 patients, 53.22%), patients with primary education (50.8%), and married people (65 patients, 52.41%).

Table 1. Frequency of qualitative demographic variables.

Demographic characteristics	N	%	p
Skin color (n = 124)			
White	58	45.77	0.00
Non-white	66	53.22	
Schooling level (n = 124)			
Illiterate	1	0.8	0.00
Primary education	63	50.8	
Secondary education	51	41.12	
Higher education	9	7.25	
Marital status (n = 124)			
Married	65	52.41	0.00
Single	46	37.09	
Separated	11	8.87	
Widower or widow	2	1.61	

Most patients treated were from the region where the hospital is a reference (63 patients, 50.80%) and not from the city where the Hospital is located (53 patients, 42.74%). Only eight patients (6.45%) were from other region or state. The main affected professions, which constituted 51.60% of all fractures, were farmers, self-employed workers, masons, and industrialists. A total of 108 patients (87%) had monthly income up to two minimum wages, 14 patients (11%) earned from two to five minimum wages a month and only two patients (1.6%), more than five minimum wages.

Only 37 patients (23.87%) had comorbidities, of which arterial hypertension was the most prevalent (42%) (Figure 1), and 17 patients (13.70%) had other associated injuries, of which closed fractures was the most frequent (Figure 2). The trauma mechanisms most related to open fractures were work-related accidents (Table 2), with equal distribution between crushing (blunt trauma) and blunt injuries. Half of the cases occurred from Thursday to Saturday (statistically significant), with higher frequency in November, January, and July (statistically non-significant) during daytime (77% of the cases) (Table 3). A percentage of 51.83% of the patients were taken to the hospital by family members and strangers, and most patients (62.90%) arrived at the hospital within 60 minutes. Upper limbs were the most affected by open fractures (64.51%) and fractures of the bones of the hands represented 58.02% of all fractures (Figure 3), most of them being a type III open fracture, according to Gustilo and Anderson[10] (Table 4). A total of 55% of the fractures were on the left side of the body. Once in the hospital, patients underwent early total care within 5 h, with predominance of resolution within the first 30 minutes (Figure 4). The main treatment was suture and dressing. The mean hospitalization time was 3.63 days, but most patients were hospitalized for only one day or not even got hospitalized (Figure 5). A total of 98% of the patients rated the initial care as good or excellent, 66% of them giving a 10 rating for the care. Only 1.6% of the patients considered the initial care from poor to average, but no one rated it lower than a 3 rating.

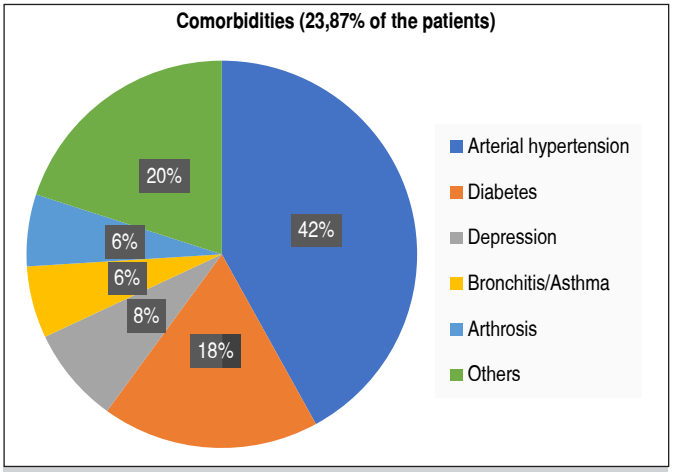

Figure 1. Comorbidities.

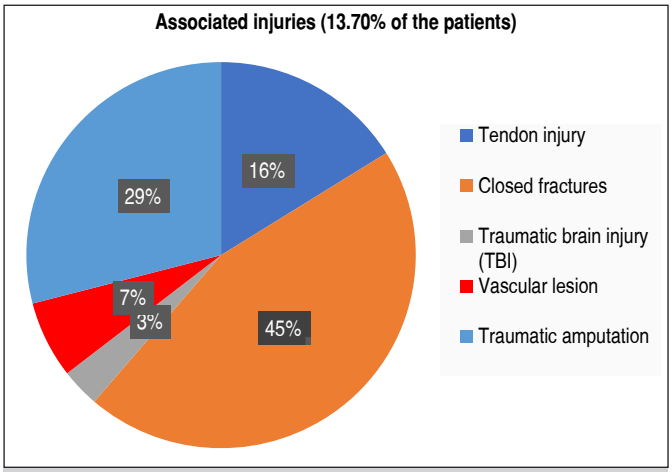

Figure 2. Associated injuries.

Table 2. Trauma mechanisms of open fractures.

CAUSE	n	%	p
Work-related trauma	49	39.51	0.00
Motorcycle	21	16.93	
Motor vehicle	15	12.09	
Fall	12	9.67	
Accident in rural areas	10	8	
Domestic trauma	9	7.25	
Aggression	2	1.61	
Dog bite	2	1.61	
Explosive material	2	1.61	
Gunshot wound	1	0.8	
Hit-and-run accident	1	0.8	
TOTAL	124	100%	

Table 3. Distribution of open fractures according to the day of the week, month, and time.

DAY	n	%	p
Monday	17	13.7	0.83
Tuesday	15	12.09	
Wednesday	17	13.7	
Thursday	22	17.74	
Friday	21	16.93	
Saturday	19	15.32	
Sunday	13	10.48	
MONTH	**n**	**%**	**P**
January	15	12.09	0.00
February	8	6.45	
March	2	1.61	
April	2	1.61	
May	9	7.25	
June	10	8.06	
July	17	13.7	
August	9	7.25	
September	6	4.83	
October	14	11.29	
November	22	17.74	
December	10	8.06	
TIME	**n**	**%**	**P**
06:01–12:00	50	40.32	0.00
12:01–18:00	46	37.09	
18:01–00:00	20	16.12	
00:01–06:00	8	6.45	

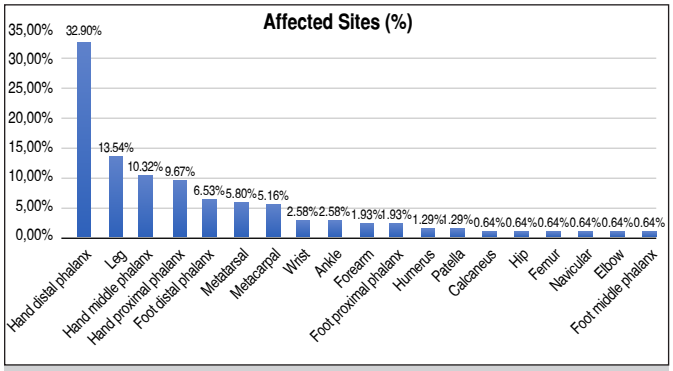

Figure 3. Bones affected.

Table 4. Distribution of open fractures regarding degree of exposure.

GUSTILO	Frequency	%	p
Type I	24	15.48	0.00
Type II	57	36.77	
Type IIIA	65	41.93	
Type IIIB	7	4.51	
Type IIIC	2	1.29	
TOTAL	155	100%	

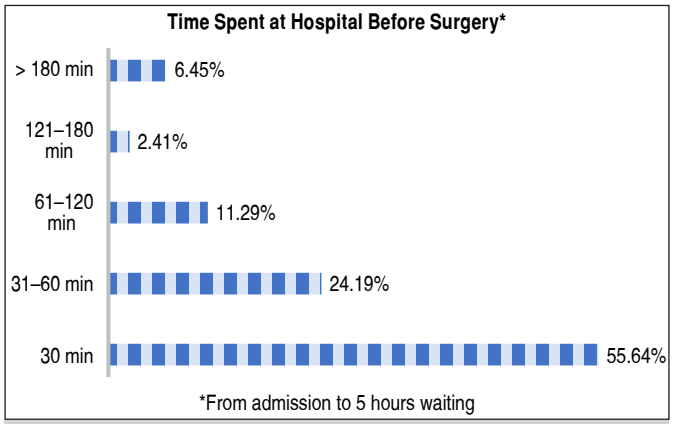

Figure 4. Time in the hospital until surgery.

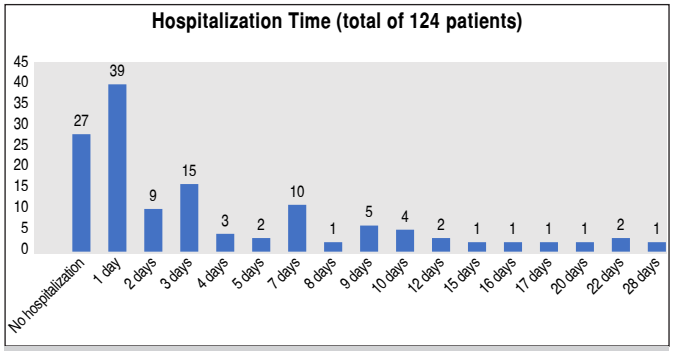

Figura 5. Hospitalization period.

DISCUSSION

Performing studies that consider variables related to the public treated daily in our public emergency health systems is extremely important.[9,12] However, studies similar to this tend to be rare and old, as the most recent ones prioritize other goals such as assessing the efficacy of therapeutic approaches and classifications.[13]

The main population with fractures is economically active and it may burden the public purse.[13] This is the reason why our study assess open fractures exclusively in the legally major population to assess the economically active patients, different from other studies that included children. No patient refused to participate in this study.

When the patient was anesthetized for treatment, we classified the open fracture. We used the Gustilo-Anderson classification of open fractures[10], modified by Gustilo, Mendonza, and Williams.[11] Although this classification is little reproduced[14] and its interobserver reliability is considered moderate to weak,[14,15] it is the most recognized and used classification worldwide, as it is easy to memorize and endorsed by the literature and clinical practice. We considered open fractures of the forearm, leg, and ankle as a single bone fracture since these region behave as a functional unit. Gustilo's type IIIA fractures were more frequent (41.93%) (statistically non-significant) (Table 4).

The skin color did not cause differences. Arruda et al.[8] observed higher incidence in non-whites, different from what was found by Muller et al.[16] (83.76% were white).

A feature in common national epidemiological studies of open fractures highlight is that the affected patients are, in general, those with low schooling, including a high illiteracy rate.[8,16,17] The schooling level of the patients assessed in our study was similar to these studies, since more than half of the patients (50.80%) completed all or part of primary education, but only 0.8% were illiterate. Patients with low schooling level tend to have low professional qualification, perform manual labor activities, and be exposed to risky activities. Another common feature of this and other studies that assessed the income of patients with open fractures is that most have low income.[7,17]

In our study, we observed no difference between married and single patients with open fracture. In places with a large number of vehicles, especially motorcycles, the most affected patients were single men.[18,19] On the other hand, in places where patients presented higher mean age, most of them were married.[16,20]

In this study, minors were excluded and the mean age of patients with open fractures was 43 years old. Most studies that assessed open fractures included children and, perhaps because of that, they presented lower mean age, around 30 years old, and the most affected age group was from 20 to 30 years old.[8,9,13,16,19]

A total of 108 patients (88%) were men. This male predominance is similar to what occurs in all literature,[11,16] in which men are predominant in trauma because they present a risk behavior potentially exposed to accidents. Arterial hypertension was the most frequent comorbidity (37 patients, 23.87%), just as in other epidemiological studies of open fractures,[7,19] but it was statistically equivalent to other comorbidities.

The most affected patients were farmers (23.38%), self-employed workers (11.29%), masons (8.87%), and industrialists (8.06%). These four professions represented more than half of the professions affected by open fractures (51.60%). The presence of masons and industrialists is due to the study being performed in a developing city with large industries and increasing civil construction activity. Self-employed workers, on the other hand, live in informality and currently represent an important portion of the Brazilian population. The presence of farmers is perhaps due to the care carried out for the small towns around, with mainly agricultural characteristics.

The main cause of open and closed fractures are traffic accidents, with a percentage ranging from 33% to 88%.[4,5,8,9,20] Car accidents are more frequent in non-industrial towns. Open fractures mostly affect lower limbs and the tibial diaphysis is the most fractured bone in patients under 65 years of age.[3-5] In this study, in absolute numbers, the most common fractures occurred due to work-related accidents (39.51%), with equal distribution between crushing (laceration trauma) and lacerations, especially regarding industrial and agricultural machines. In a study that considered work-related accidents as the main cause of fractures, they were related to the crushing of limbs.[1] The frequency of open fractures was higher in hand bones (phalanges and metacarpals) (58.02%), especially in the distal phalanx (32.9%). Open hand fractures affect more residents of industrial cities and manual labor professionals such as masons and farmers.[4]

The highest numbers of accidents occurred on Thursdays (17.74%), Fridays (16.93%), and Saturdays (15.32%), which together represent 50% of all open fractures. Most open fractures occurred on weekends, especially on Sundays, in relation to the consumption of alcoholic beverages.[13,17] A percentage of 77% of the open fractures occurred during daytime. This time slot also differs from national studies in which a higher number of open fractures occurred at night.[8,13]

A total of 51.83% of the aid was provided by family members (25.22%) and third parties (26.61%), unlike the study by Arruda et al.[8], in which most patients were aided by firefighters. The Mobile Emergency Care Service (SAMU) recently started its activities in the region, which may explain the lack of specialized service regarding initial emergency care and transportation to the hospital.

The quality of services is related to the customer's expectation and their satisfaction with the experience. User satisfaction surveys are indispensable for planning and evaluating health services and may provide to their managers the information required to define surgery strategies. After care or the next day, the patients answered a numerical satisfaction scale regarding the initial care

and we observed a high satisfaction rate. Since most patients were not polytraumatized, we lost little time in other medical evaluations and urgent surgeries, speeding up the initial care. Moreover, the service presents an emergency room available for traumas, speeding up, in most cases, the time between patients arriving to the hospital and being taken to the operating room. Moreover, the doctor-patient relationship may have favored high grades from patients in public services, a frequent subject of complaints. Braga Junior et al.[7] also evaluated grades of the care provided to musculoskeletal traumas in general. Less than half (48%) were patients with fractures, and, despite a high level of patient satisfaction, those who complained did so especially because of the delay in care. In this study, we did not ask the dissatisfied group (1.6%) the reasons for the low grade, so we could not identify the possible failures to improve the qualification process for improving hospital care.

CONCLUSIONS

The patients with open fractures treated in this study presented the following profile: Healthy man, mean age of 43 years old, low schooling level, low income, upper limb accident victim, especially in the bones of the hands, treated between Thursday and Saturday, during daytime. Most were satisfied with the initial care provided.

AUTHORS' CONTRIBUTIONS: Each author contributed individually and significantly to the development of this article. FCC: data analysis, statistical evaluation, and bibliographic research; JMR: data analysis, statistical evaluation, and bibliographic research; SPR: data analysis, statistical evaluation, and bibliographic research; LAB: data capture and tabulation; NFM: data capture and tabulation; CDMA: study design and final draft.

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