

THE IMPACT OF COVID-19 ON THE EPIDEMIOLOGICAL PROFILE OF FRACTURES

O IMPACTO DA COVID-19 SOBRE O PERFIL EPIDEMIOLÓGICO DE FRATURAS

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ABSTRACT

Objective: To analyze the epidemiological transition of fractures in patients who were treated in a tertiary hospital which is reference in traumatology during the COVID-19 pandemic to assess the changes in trauma service. **Methods:** This is a retrospective and descriptive analysis of data on orthopedics lesions treated at Instituto Doutor Jose Frota between December 16, 2019 and June 16, 2020 (three months before and after the first case of COVID-19 in Ceará). **Results:** In total, we evaluated 913 patients, 28.5% of which were women and 71.5%, men. We found a significant reduction ($p < 0.05$) in the proportion of female patients operated in the analyzed time. We also observed an increase in patients' mean age, 35.4 years before the pandemic, and 38.48 ($p = 0.04$) during the consecutive period. Trauma mechanisms significantly changed ($p < 0.05$), with a proportional increase of high-energy traumas and reduction of instances of falling. We found a 11.9% reduction in orthopedic surgeries, from 655 to 577 at the time after the first case of COVID-19 ($p = 0.071$). Mean hospitalization length ($p < 0.001$) and time until surgeries decreased ($p < 0.001$). **Conclusion:** We observed the impact of lockdown in this hospital of trauma especially via the decreased number of operated cases and the change in patients' profile and trauma mechanism. **Level of Evidence III, Retrospective Comparative Study.**

Keywords: COVID-19. Traumatology. Fractures, Bone. Epidemiology.

RESUMO

Objetivo: Analisar a transição do perfil epidemiológico de fraturas de pacientes atendidos em um hospital terciário referência em traumatologia durante a pandemia de COVID-19, a fim de verificar mudanças no atendimento traumatológico. **Métodos:** Análise retrospectiva e descritiva dos dados de lesões ortopédicas admitidas no Instituto Doutor José Frota entre 16 de dezembro de 2019 e 16 de junho de 2020 (três meses antes e depois do primeiro caso de COVID-19 no Ceará). **Resultados:** Dos 913 pacientes avaliados, 28,5% eram mulheres e 71,5% homens. Houve redução significativa ($p < 0,05$) nas proporções de mulheres operadas no tempo analisado. Houve aumento na média da idade, sendo 35,40 anos pré-pandemia, e 38,48 ($p = 0,04$) no período seguinte. Os mecanismos de trauma mudaram significativamente ($p < 0,05$), com aumento proporcional de fraturas por alta energia e redução no número daquelas por queda ao solo. A quantidade de cirurgias ortopédicas reduziu em 11,9%, de 655 antes do primeiro caso de COVID-19 para 577 posteriormente ($p = 0,071$). A média do número de dias diminuiu para duração do internamento ($p < 0,001$) e para o tempo até a realização da cirurgia ($p < 0,001$). **Conclusão:** O impacto do lockdown neste hospital de trauma se deu principalmente pela diminuição na quantidade de casos operados e pela mudança do perfil e mecanismo de trauma dos pacientes. **Nível de Evidência III, Estudo Retrospectivo Comparativo.**

Descritores: COVID-19. Traumatologia. Fraturas Ósseas. Epidemiologia.

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INTRODUCTION

At the end of 2019, a viral outbreak¹ surprised China, putting countries around the world on alert as they observed the pronouncements of the World Health Organization (WHO)² and the evolution of circumstances in the Chinese territory. In February 2020, Brazil

would register its first official infection case by the new Coronavirus (SARS-CoV-2).³ In Ceará, the first official notification of infection with COVID-19 occurred on March 16, 2020,⁴ increasing to more than 690,000 confirmed cases and 18,000 deaths⁵ until the 17th Epidemiological Week (May 1, 2021).

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The study was conducted at Instituto Doutor José Frota.

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The WHO recommends that countries have a ratio of at least one doctor per 1,000 inhabitants. According to the latest data from its Federal Council of Medicine (CFM),⁶ Brazil meets this requirement, with almost 2.2 such professionals per 1,000 Brazilian citizens. However, the particularities of COVID-19, such as its great capacity for dissemination and the poor knowledge of effective treatment, can still raise it to a level which would justify caution, forcing drastic measures from public managers and completely changing the routine of the Brazilian people.

Social distancing, constant hand sanitizing, mandatory mask use, quarantine status, lockdown, and changes in the internal dynamics of health centers are among the guidelines to alleviate the spread of the virus.⁷ This change also included orthopedic and trauma services. Some international hospitals, such as those in Italy and Nepal, have decided to suspend all elective or non-emergency procedures (except for cancer patients) since some orthopedic surgeries can lift possibly contaminated aerosols.⁸ Additionally, such centers have aimed to make as many ICU beds vacant as possible for COVID-19+ patients, preserve health resources, and avoid possible hospital contamination for other patients.^{9,10} Moreover, this conduct enables channeling orthopedic physicians and colleagues from other specialties (including residents) to meet the large number of individuals infected by the new Coronavirus. Note, however, that social isolation and traffic control can positively and negatively impact Brazilian medical services. On the one hand, secluding people in their homes promotes viral containment and reduces traffic accidents (as a study conducted in New Zealand¹¹ has shown). On the other hand, it hinders the transit of older individuals or accident victims, especially those in rural areas or who use public transport in cities which reduced their operating fleet. All these changes modified the profile of patients treated by trauma centers throughout Brazil.¹² Understanding this transition, especially in a constantly changing pandemic, is important to enable the adjustment of care to ensure efficient service with the greatest possible safety for patients and healthcare providers.

Thus, this study aims to analyze how the epidemiological profile of fractures in patients treated in a tertiary hospital (which is a reference in traumatology) changed during the COVID-19 pandemic to offer a panoramic view of what occurred regarding trauma care.

METHODS

This is a retrospective and descriptive analysis of records from patients with orthopedic lesions admitted 90 days before and after the first case of COVID-19 in Ceará State, Brazil, in a local tertiary trauma center.

Data from patients admitted to Instituto Doutor José Frota (IJF), a regional reference trauma center, between December 16, 2019 and June 16, 2020, were analyzed, corresponding to periods between three months before the first COVID-19 case in Ceará and three months afterward.

Patients of all genders with mature or immature skeletons — shown via radiography (i.e., those with closed epiphyseal plates) — who suffered orthopedic lesions and were treated and operated on at IJF from December 16, 2019 to June 16, 2020 were included in this study.

Patients with fractures only on their ribs or face, those who had no orthopedic lesions on admission, who lacked adequate imaging tests, and who showed inadequate medical records were excluded from this study.

Identification data (medical record number, age, gender), affected side, comorbidities, fractured bones, aspects of the trauma mechanism, date of the trauma, performed surgery dates, hospitalization length, time until surgeries, and number of performed surgeries were collected.

Fractures types were systematized into large groups according to the affected body segment: Shoulder (clavicle, proximal humerus, and scapula), diaphyseal humerus fractures, elbow (distal humerus, olecranon, radial head, and elbow fracture-dislocation), forearm (radius and ulna diaphyseal fractures, alone or combined), wrist (distal radius and carpal fracture and fracture-dislocations), hand (phalanges and metacarpal bones), pelvis and acetabulum (pelvic ring and sacrum fracture-dislocations and acetabulum fractures), hip (neck, transtrochanteric, and subtrochanteric proximal femur fractures), femur diaphyseal fractures, knee (distal femur, patella, and tibial plateau), legs (leg bone diaphyseal fractures, alone or combined), ankle, tibial pilon, and foot (tarsal and metatarsal bones and phalanges).

Minimums, maximums, medians, means, and standard deviations were used to describe quantitative variables and patient number and proportion, for qualitative ones. The Z-test was used to compare proportions between two analyzed periods; the Student's t-test, normal distributions; and the Mann-Whitney test, abnormal distributions. The Shapiro-Wilk test was used to assess sample distribution normality. A $p \leq 0.05$ statistical significance was considered.

According to Resolution 466/2012 of the National Health Council, this study was approved by the Research Ethics Committee of the institution via opinion no. 4,140,174.

RESULTS

Of 913 evaluated patients, 260 (28.5%) were women and 653 (71.5%), men (Table 1). We found a significant reduction ($p < 0.05$) in the proportion of female patients operated before and during the first three months of restrictive measures (Table 2).

We found that the mean age of patients evaluated in the period before the pandemic (35.40 years) increased during the evaluated social isolation to 38.48 years ($p = 0.04$) (Table 3)

Hips (13.43%), forearms (12.27%), and elbows (11.11%) were the body segments which showed the highest number of operations in the first studied period. During social isolation, they consisted of legs (16.09%), knees (11.87%), and hips (11.68%).

We found a significant difference ($p < 0.05$) between trauma mechanisms in the evaluated periods, with a proportional increase of fractures caused by car accidents, aggressions, cars running over pedestrians, and gunshot wounds (GW) and a reduced number of fractures resulting from falls to the ground (Table 4).

Table 1. Number and percentage of patients per variable.

Variable	N	%
Gender		
Female	260	28.5
Male	652	71.5
Comorbidities		
No	794	87.8
Yes	103	11.4
Comorbidities*		
SAH	52	5.8
DM	30	3.3
Cadiopathy	9	1
Joint GW		
No	53	71.6
Yes	21	28.4
Articular GW with bone loss		
No	25	86.2
Yes	4	13.8

* Multiple answers; SAH: systemic arterial hypertension; DM: diabetes mellitus, GW: gunshot wound.

Table 2. Number and percentage of patients by variable and period.

Gender	Period	N	%	p*
Female	Before	160	61.5	< 0.001
	After	100	38.5	
Male	Before	337	51.7	0.193
	After	315	48.3	
Comorbidity				
SAH	Before	24	4.8	0.092
	After	28	6.7	
DM	Before	16	3.2	0.434
	After	14	3.4	
Cardiopathy	Before	7	1.4	0.077
	After	2	0.5	
Joint GW				
No	Before	21	39.6	-
	After	32	60.4	
Yes	Before	12	57.1	-
	After	9	42.9	
Articular GW with bone loss				
No	Before	10	40.0	-
	After	15	60	
Yes	Before	2	50.0	-
	After	2	50.0	

* Z-test for difference in proportions; SAH: systemic arterial hypertension; DM: diabetes mellitus; GW: gunshot wound.

Table 3. Descriptive statistics of quantitative variables.

Variables	n	Minimum	Maximum	Median	Mean	SD
Age	912	2	97	32.0	36.80	22.74
Hospitalization length (days)	911	1	155	11.0	17.64	18.29
1 st surgery (days)	912	0	83	3.0	6.92	10.00
2 nd surgery (days)	231	0	86	13.0	18.35	16.00
3 rd surgery (days)	37	4	89	30.0	32.62	20.18
4 th surgery (days)	10	5	84	38.5	42.60	24.86
5 th surgery (days)	4	15	125	47.5	58.75	47.26
6 th surgery (days)	2	44	146	95.0	95.0	72.12
Surgery amount	912	0	6	1.0	1.35	0.65

We found no statistically relevant difference among comorbidities in both evaluated patient groups. Among the comorbidities reported in the first period, 24 patients (4.8%) showed systemic arterial hypertension; 16 (3.2%), diabetes mellitus; and 7 (1.0%), heart disease. Of the patients evaluated in the following three months, 28 (6.7%) reported SAH ($p = 0.092$); 14 (3.4%), diabetes ($p = 0.434$); and 2, (0.5%) cardiopathies ($p = 0.077$). Other pathologies showed very low percentages ($< 1\%$) in both evaluated periods and most patients (87%) showed no comorbidities (Table 2).

The number of orthopedic surgeries performed decreased by 11.9%, from 655, before the first case of COVID-19 in Ceará, to 577 after it ($p = 0.071$).

We found a significant difference between both analyzed periods regarding hospitalization length ($p < 0.001$) and time until surgery(ies) ($p < 0.001$), with a decrease in their mean number of days (Table 5).

DISCUSSION

The pandemic is still a reality in 2021, despite the development of vaccines against SARS-CoV-2. For example, according to data from its Ministry of Health,³ the number of daily deaths in Brazil due

Table 4. Number and percentage of patients by trauma mechanism and period.

Trauma mechanism	Period	n	%	p*
Car accident	Before	19	3.8	< 0.001
	After	46	11.1	
Bicycle Accident	Before	9	1.8	0.447
	After	8	1.9	
Motorcycle accident	Before	180	36.1	0.126
	After	135	32.5	
Aggression	Before	4	0.8	0.007
	After	13	3.1	
Pedestrian versus motor vehicle accidents	Before	19	3.8	0.025
	After	28	6.7	
GW	Before	38	7.6	0.038
	After	46	11.1	
Fall to the ground	Before	179	35.9	< 0.001
	After	92	22.2	
Fall from height	Before	34	6.8	0.354
	After	31	7.5	
Other falls	Before	12	2.4	0.220
	After	7	1.7	
Others	Before	4	0.8	0.048
	After	9	2.2	

*Z-test for difference in proportions; GW: gunshot wound.

Table 5. Descriptive statistics and comparison between periods before and after the pandemic.

Period	Period	n	Minimum	Maximum	Median	Mean	SD	p
Age(years)	Before	498	2	96	30.0	35.40	23.97	0.04 ^a
	After	414	2	97	36.0	38.48	21.06	
Hospitalization length (days)	Before	498	1	155	15.5	21.55	19.60	< 0.001 ^a
	After	413	1	151	8.0	12.93	15.31	
1 st surgery (days)	Before	498	0	83	5.0	9.19	11.82	< 0.001 ^a
	After	414	0	67	2.0	4.18	6.22	
2 nd surgery (days)	Before	126	0	86	17.0	23.05	18.31	< 0.001 ^a
	After	105	2	72	10.0	12.71	10.22	
3 rd surgery (days)	Before	19	4	89	36.0	39.47	21.82	0.024 ^b
	After	18	6	72	26.0	25.39	15.82	
4 th surgery (days)	Before	6	5	71	37	41.00	25.08	-
	After	4	17	84	39.5	45.00	28.15	
5 th surgery (days)	Before	2	15	56	35.5	35.50	28.99	-
	After	2	39	125	82.0	82.00	60.81	
6 th surgery (days)	Before	0	-	-	-	-	-	-
	After	2	44	146	95.0	95.0	72.12	
Surgery amount	Before	498	0	5	1.0	1.32	0.61	0.071
	After	414	1	6	1.0	1.39	0.68	

^a Student's t-test; ^b Mann-Whitney test.

to the second wave of the COVID-19 pandemic reached 4,249 on April 8, 2021. In the same period, massive vaccination decreased the number of cases in the United States, in contrast to its alarming and uncontrolled spread in India.¹³ These data reflect how the

pandemic affects nations differently, either by more than one wave of contamination, by the varying number of lives lost or by the adopted containment policies.

The trauma hospital which is the focus of this study conducted 11.9% less orthopedic surgeries throughout the analyzed periods, which we expected due to restrictive measures reducing urban mobility and suspending elective surgeries. Other orthopedic and trauma sectors outside Brazil^{14,15} saw the same reduction trend. Additionally, orthopedic centers in Southeastern Brazil¹² and trauma hospitals in London¹⁶ also observed a decrease in waiting time for surgeries and hospitalization time, respectively. These aspects align management to reduce risk of exposure to the virus and attempt to allocate as many beds and inputs as possible for patients with COVID-19.

Another parameter we observed was the subtle increase in the mean age of treated patients: 35.4 years in the “pre-COVID” period and 38.5 years in the following one. This trend, which other studies also report,¹⁷ may relate to the imposed restrictive measures probably reducing the participation of young people in motorcycle accidents, whose prevalence is due to greater recklessness and recreational use.

The studied period also shows increased fractures due to high-energy traumas, such as automobile accidents, assaults, cars running over pedestrians, and GW. This trend is unexpected since restrictive measures should reduce circulating vehicles and the number of people on the streets, as other trauma centers^{15,17} have reported.

However, some factors may explain this non-reduction of high-energy traumas. The late lockdown officialization in the region of the studied trauma hospital¹⁸ (only in the first week of May, after Decree No. 33,574) may be one such explanation, before which the region only had a few looser isolation measures. Another cause to be considered is that the studied health center treats patients from several nearby regions, who received the announcement of the lockdown at different times – whether, in some municipalities, at the end of May and, in others, only in June.¹⁹ We stress that, in fact, some localities left the lockdown while others were adopting the regime, both assisted by this same reference trauma center, contributing once again to the non-reduction of high-energy traumas.

Additionally, the increase in violence resulting from unemployment²⁰ (especially from individuals unassisted by the national emergency aid, established on April 2, 2020, by Law No. 13,982,²¹ but whose

concession had a late onset)²² and the shutdown of Ceará²³ military police activities for about two weeks in the first quarter, which may have contributed to the greater number of GW we found. According to the Violence Monitor, a tool developed by the Center for the Study of Violence at Universidade de São Paulo in partnership with the Brazilian Public Security Forum and G1, Brazil recorded 5% more murders in 2020 than in 2019 — and the Northeast negatively stood out for its significant 20% occurrence increase.²⁴

Although we can satisfactorily observe an epidemiological transition in the profile of treated patients, the short period this study analyzed may be a limiting factor to finding more expressive changes. Thus, analysis of a longer period and mapping the origin of serviced patients could more accurately illustrate the impacts of the lockdown in each region, providing more solid bases for local health managers' future decision-making, favoring a specific alignment of care to ensure a more efficient and safe service for all.

Regarding future perspectives, we must highlight the protagonism of telemedicine. In fact, hospitals have implemented hybrid care into their orthopedic services during the pandemic, involving face-to-face contact with patients and steps performed over the telephone and obtaining good results regarding complaint resolution.²⁵ As of this study, Brazil is experiencing its second COVID-19 pandemic wave, with restrictive locomotion and commercial activities measures periodically still in vogue. Thus, analyzing the implementation of telemedicine in stages of care at the IJF would prove timely and with advantageous possibilities for patients and healthcare providers.

CONCLUSION

The impact of the lockdown during the first wave of the Coronavirus pandemic in a reference trauma hospital decreased the number of operated cases and changed trauma mechanism patterns and the profile of patients undergoing surgery.

Understanding the transition of patients' profile and trauma treated during the pandemic enabled the planning of strategies and optimized its approach and trauma care during this phase of the pandemic and for the subsequent waves of COVID-19 cases which will overload the health system.

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