

# EPIDEMIOLOGICAL ANALYSIS OF FRACTURES IN THE PREVIOUS PERIOD AND DURING THE QUARANTINE OF COVID-19

## ANÁLISE EPIDEMIOLÓGICA DE FRATURAS ANTES E DURANTE A QUARENTENA DE COVID-19

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### ABSTRACT

**Objectives:** Our aim was to compare the epidemiology of surgically treated fractures during the pandemic period with previous years without the pandemic. **Methods:** This was a retrospective study with data collection that included patients hospitalized and operated for fractures between March 24th and June 23rd in 2018, 2019 and 2020. **Results:** A total of 879 patients were registered, resulting in a total of 965 fractures. During the COVID-19 pandemic, 234 patients were registered, representing 26.62% of the total, and in the period before the pandemic, 645 patients were registered, 73.38% of the total. **Conclusion:** We observed a proportional increase in high-energy trauma in the social isolation period and patient's average age. The other changes found in the study had no statistical difference.

**Level of Evidence IV, Case Series.**

**Keywords:** COVID-19. Pandemics. Aged. Fractures, Bone. Epidemiology.

### RESUMO

**Objetivos:** Comparar a epidemiologia das fraturas tratadas cirurgicamente durante o período de contingência causado pela pandemia com os intervalos respectivos de anos anteriores. **Métodos:** Foram incluídos todos os pacientes com diagnóstico de fratura em qualquer seguimento do corpo, exceto coluna vertebral e face, que foram internados e operados entre 24 de março e 23 de junho de 2018, 2019 e 2020 em dois hospitais referência para tratamento de trauma na grande São Paulo. Os dados foram obtidos a partir da avaliação retrospectiva de prontuários médicos. Levou-se em consideração epidemiologia das fraturas, mecanismo de trauma e dados demográficos dos pacientes tratados no período de contingência em comparação com a média dos três anos anteriores (período controle). **Resultados:** Foram avaliados 879 pacientes e 965 fraturas. Durante a pandemia pelo coronavírus foram registrados 234 pacientes, enquanto a média do período controle foi de 322,5 pacientes. Em relação ao mecanismo de trauma, houve um significativo aumento do trauma de alta energia em comparação ao período controle. **Conclusão:** Verificou-se uma diminuição na incidência de fraturas tratadas cirurgicamente nos hospitais avaliados. No entanto, houve uma elevação na taxa de trauma de alta energia no período de isolamento social. Essa alteração demonstra que mudanças no fluxo das cidades podem impactar na demanda hospitalar e que a pandemia influenciou direta e indiretamente os órgãos de saúde. **Nível de Evidência IV, Série de Casos.**

**Descritores:** COVID-19. Pandemias. Idoso. Fraturas Ósseas. Epidemiologia.

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### INTRODUCTION

Since the first reported case of acute respiratory disease caused by SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2), in December 2019, we watched the virus spreading. On March 11, 2020, with the infection increasing in several countries,

the World Health Organization has declared that the COVID-19 outbreak is a global pandemic. In Brazil, as well as worldwide, we followed the disease outbreak. On March 24, 2021, the State of São Paulo government decreed a contingency plan, restricting open

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

The study was conducted at Hospital São Paulo and Hospital Municipal de Barueri Dr. Francisco Moran.

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establishments and changing mobility through social distancing, aiming to limit the virus spread.

The epidemiology of fractures is often associated with the patient's age group, gender, and comorbidities, as well as functional profile and type of activity. Moreover, the incidence may follow a seasonal pattern. For example, proximal femur fractures are commoner in women over 60 years and in the winter. The sudden change in the habits of the Brazilian population due to the quarantine probably brought general epidemiological changes, as well as orthopedic traumatic pathologies.

Our study aims to evaluate whether this social alteration, especially in the red phase period enacted by the contingency plan of the State of São Paulo due to the COVID-19 pandemic, influenced the epidemiology of fractures treated by the orthopedic department in two referral hospitals in the State of São Paulo in 2020 compared to the same period in 2019 and 2018. Our hypothesis is that the number of fractures treated surgically would be lower than usual in the mobility restriction period. Proportionally, a decrease would occur in the number of fractures caused by high-energy trauma, due to decreased vehicle flow.

## METHODS

In this study, were evaluated patients diagnosed with acute fractures in any part of the body, except for the spine and face, treated surgically in the orthopedics sector of Hospital São Paulo, at the city São Paulo, and the Municipal Hospital of Barueri Dr. Francisco Moran, at the city Barueri, part of the metropolitan area of São Paulo. All patients who entered these services in the red phase period imposed by the contingency plan of the State of São Paulo, from March 24 and June 10, 2020, were included in the study. The control group included all patients treated in the same period in the previous two years, 2018 and 2019.

The Ethics Committee of both institutions approved this study, which was submitted to Plataforma Brasil (opinion No. 45016620.6.0000.5505). Patients list was obtained via hospital admission system. The evaluated data were collected from the medical records via retrospective analysis. The data collected were age, gender, trauma mechanism, fracture anatomical location, date of trauma, and laterality. Regarding trauma energy, all sprains and falls without unevenness were considered low energy. Other traumas were considered high energy.

The diagnoses were reviewed by two independent evaluators. The anatomical location in the long bones was defined as diaphyseal, proximal, and distal, according to the AO classification.

## Statistical analysis

A comparative analysis was performed between groups of patients treated during the COVID-19 quarantine and patients treated in the same period in 2019 and 2018. Data with continuous variables were analyzed using the t-test and categorical data were analyzed using Fisher's test.

## RESULTS

During the study period, 879 patients were recorded. Some patients presented more than one fracture at the time of the incident, totaling 965 fractures. During the COVID-19 pandemic, 234 patients were recorded. In the control interval, 645 patients were recorded: 311 in 2019 and 334 in 2018. Table 1 shows patient's demographic data, trauma mechanism, and fracture's location. Tables 2 and 3 show the same data, but from Hospital Municipal de Barueri Dr. Francisco Moran and Hospital São Paulo, respectively.

Patients mean age was higher in the COVID period. It is statistically significant when we analyze only the Hospital São Paulo, with a 50.27 mean age in the COVID period against 42.87 in the non-COVID period. The number of female patients was the lowest in both periods: 74 (32%) in the Coronavirus period and 216 (33%) in the non-Coronavirus period.

**Table 1.** Sample characterization and fracture prevalence in each period in both hospitals.

	COVID n (%)	Not COVID n (%)	p
<b>Number of patients</b>	234	645	
Age (mean/SD)	43.09 ± 1.44	40.05 ± 0.84	0.06
<b>Sex</b>			0.62
Female	32%	33%	
Male	68%	67%	
<b>Trauma energy</b>			0.047
Low	34%	43%	
High	66%	57%	
<b>Fracture location</b>			0.43
Hand	9.43%	9.71%	
Feet	4.53	6.00%	
Proximal humerus	3.02%	2.43%	
Diaphyseal humerus	2.64%	2.71%	
Distal humerus	3.40%	4.57%	
Scapula	0.38%	0.00%	
Clavicle	1.51%	1.71%	
Proximal radius	5.28%	4.86	
Diaphyseal radius	7.17%	3.71%	
Distal radius	5.28%	7.43%	
Proximal femur	13.21%	12.86%	
Diaphyseal femur	6.79%	5.71%	
Distal femur	3.02%	1.43%	
Patella	1.89%	2.71%	
Tibial plateau	5.28%	4.43%	
Diaphyseal tibial	8.30%	9.71%	
Distal tibial	3.40%	3.29%	
Ankle	12.45%	15.29%	
Pelvis	1.13%	0.29%	
Acetabulum	1.89%	1.14%	
<b>Number of fractures</b>			0.113
1	88.89%	92.86	
2	8.97%	6.05%	
3	2.14%	0.77%	
4	0.00%	0.32%	

In both periods occurred a high-energy trauma predominance. When these two intervals were compared, there was an increase in the percentages of High Energy trauma from 57% in the non-Coronavirus period to 66% in the Coronavirus period, and the difference was statistically significant ( $p = 0.047$ ). Comparing them show an increase in the high-energy trauma percentages, going from 57% in the non-Coronavirus to 66% in the Coronavirus period. The difference is statistically significant ( $p = 0.047$ ).

During the pandemic period, scapula, proximal humerus, proximal radius, diaphyseal radius, proximal femur, diaphyseal femur, distal femur, tibial plateau, tibial distal, pelvis, and acetabulum fractures increased, but without statistical significance (Table 1).

## DISCUSSION

This study delivered interesting information on the epidemiological change of fractures due to the quarantine. We observed a fall in incidence and fractures, and a proportional increase in high-energy trauma.

First, we expected a decrease in high-energy trauma, which are mostly caused by traffic collision. We believed that this type of

**Table 2.** Sample characterization and fracture prevalence in each period at the Hospital Municipal de Barueri Dr. Francisco Moran.

	COVID n (%)	Not COVID n (%)	p
<i>Number of patients</i>	151	448	
Age (mean/SD)	39.15 ± 1.72	38.8 ± 0.96	0.85
<b>Sex</b>			0.91
Female	31%	31%	
Male	89%	69%	
<b>Trauma energy</b>			0.043
Low	31%	42%	
High	69%	58%	
<b>Fracture location</b>			0.44
Hand	13.33%	12.29%	
Feet	6.06%	6.25%	
Proximal humerus	4.24%	1.88%	
Diaphyseal humerus	3.03%	2.50%	
Distal humerus	4.85%	3.96%	
Scapula	0.00%	0.00%	
Clavicle	1.21%	2.08%	
Proximal radius	4.24%	5.21%	
Diaphyseal radius	7.88%	3.54%	
Distal radius	7.88%	9.58%	
Proximal femur	9.09%	11.04%	
Diaphyseal femur	4.24%	5.00%	
Distal femur	2.42%	1.04%	
Patella	1.82%	2.71%	
Tibial plateau	6.06%	3.54%	
Diaphyseal tibial	5.45%	8.75%	
Distal tibial	4.24%	3.33%	
Ankle	13.94%	16.88%	
Pelvis	0.00%	0.00%	
Acetabulum	0.00%	0.42%	
<b>Number of fractures</b>			0.7
1	92.1%	94.2%	
2	6.6%	4.7%	
3	1.3%	0.9%	
4	0.0%	0.2%	

**Table 3.** Sample characterization and fracture prevalence in each period in both hospitals.

	COVID n (%)	Not COVID n (%)	p
<i>Number of patients</i>	83	197	
Age (mean/SD)	50.27 ± 2.42	42.87 ± 1.68	0.015
<b>Sex</b>			
Female	31%	39%	
Male	69%	61%	
<b>Trauma energy</b>			0.51
Low	40%	44%	
High	60%	56%	
<b>Fracture location</b>			0.39
Hand	3%	4.09%	
Feet	2%	5.45%	
Proximal humerus	1%	3.64%	
Diaphyseal humerus	2%	3.18%	
Distal humerus	1%	5.91%	
Scapula	1%	0.00%	
Clavicle	2%	0.91%	
Proximal radius	7%	4.09%	
Diaphyseal radius	6%	4.09%	
Distal radius	1%	2.73%	
Proximal femur	20%	16.82%	
Diaphyseal femur	11%	7.27%	
Distal femur	4%	2.27%	
Patella	2%	2.73%	
Tibial plateau	4%	6.36%	
Diaphyseal tibial	13%	11.82%	
Distal tibial	2%	3.18%	
Ankle	10%	11.82%	
Pelvis	3%	0.91%	
Acetabulum	5%	2.73%	
<b>Number of fractures</b>			0.132
1	83.1%	89.9%	
2	13.3%	9.1%	
3	3.6%	0.5%	
4	0.0%	0.5%	

trauma would significantly decrease due to the social isolation implemented in the state of São Paulo, since the number of vehicles in the streets drastically decreased.

In the *Companhia de Engenharia de Tráfego* (The Traffic Engineering Company - CET) annual report of the State of São Paulo,<sup>1</sup> we observed a decrease in traffic collision traumas in 2020, but an increase in the absolute number of fatal victims, thus indicating a significant increase in trauma severity. This data compares with our results on the patient's profile.

Moreover, we also observed an increase in distal tibial, diaphyseal tibial, tibial plateau, and scapular fractures, which are usually related to high-energy trauma mechanisms (Figure 1).

In a similar study conducted in China by Zhu et al.,<sup>2</sup> an increase in low-energy fractures highlighted proximal femur fractures within this group, mostly happening in the residential environment. We also found this datum. Although low-energy trauma was lower than in the other periods, proximal femur fracture was higher between older adults. This may justify by the confinement situation, which is similar to cold periods when the incidence of proximal femur fracture in older adults increases.

The difference between our and Zhu et al.<sup>2</sup> study is possibly due to the restrictive measures imposed by each government. China adopted considerable transportation restrictions. Only health workers and administrative state members were allowed to transit, which resulted in a population isolated at home, leaving the highways and roads free. In contrast, São Paulo restrictions were lighter. Furthermore, closing the commerce increased the delivery-service demand, which is usually made by motorcyclists in Brazil. This raised the number of motorcyclists in the streets. Data from Infosiga SP<sup>3</sup> showed a 45.5% increase in traffic accidents with motorcyclists during the pandemic and a 13.5% increase in deaths.

From what our data suggested, we found that hospitals differed. Hospital São Paulo, despite offering quaternary reference service, finds that users' spontaneous search constitutes its main demand. According to the Instituto Brasileiro de Geografia e Estatística (Brazilian Statics Institute - IBGE),<sup>4</sup> 20.3% of the population near the hospital is over 60 years. In contrast, Hospital Municipal de Barueri Dr. Francisco Moran receives patients transferred from the entire city of Barueri, in which only 7.18% of the population is over 60 years. The percentage of older adults with proximal femur fractures differs in each hospital. At the first hospital, the number

of fractures were 20% and 16.82%, respectively, in the COVID-19 period and in previous years (Figure 3). Considering the same period, the number of fractures at the second hospital was 9.09% and 11.04% (Figure 2).

Furthermore, at Hospital São Paulo, hand and wrist bones fractures are mostly referred to an associated service, reducing the occurrence of these kind of fractures in this study.

### CONCLUSION

Over time, the epidemiology of fractures changes as people change their lifestyle. Our study shows that the change imposed by the contingency plan on COVID-19 significantly changed the epidemiological profile of fractures surgically treated by the orthopedics sector of two hospitals in São Paulo. This demonstrates that the pandemic affected the health system directly and indirectly.

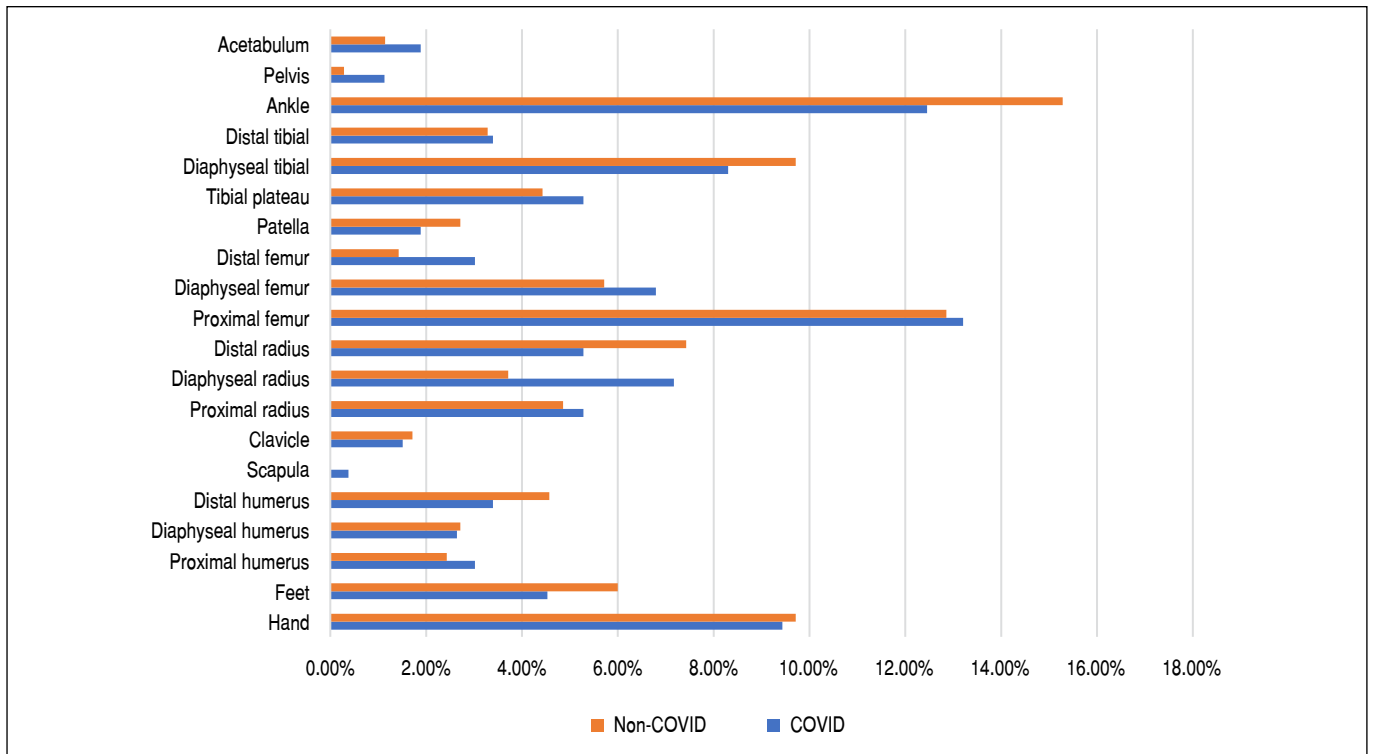


Figure 1. Comparative graph of fractures in both hospitals between the COVID and non-COVID groups.

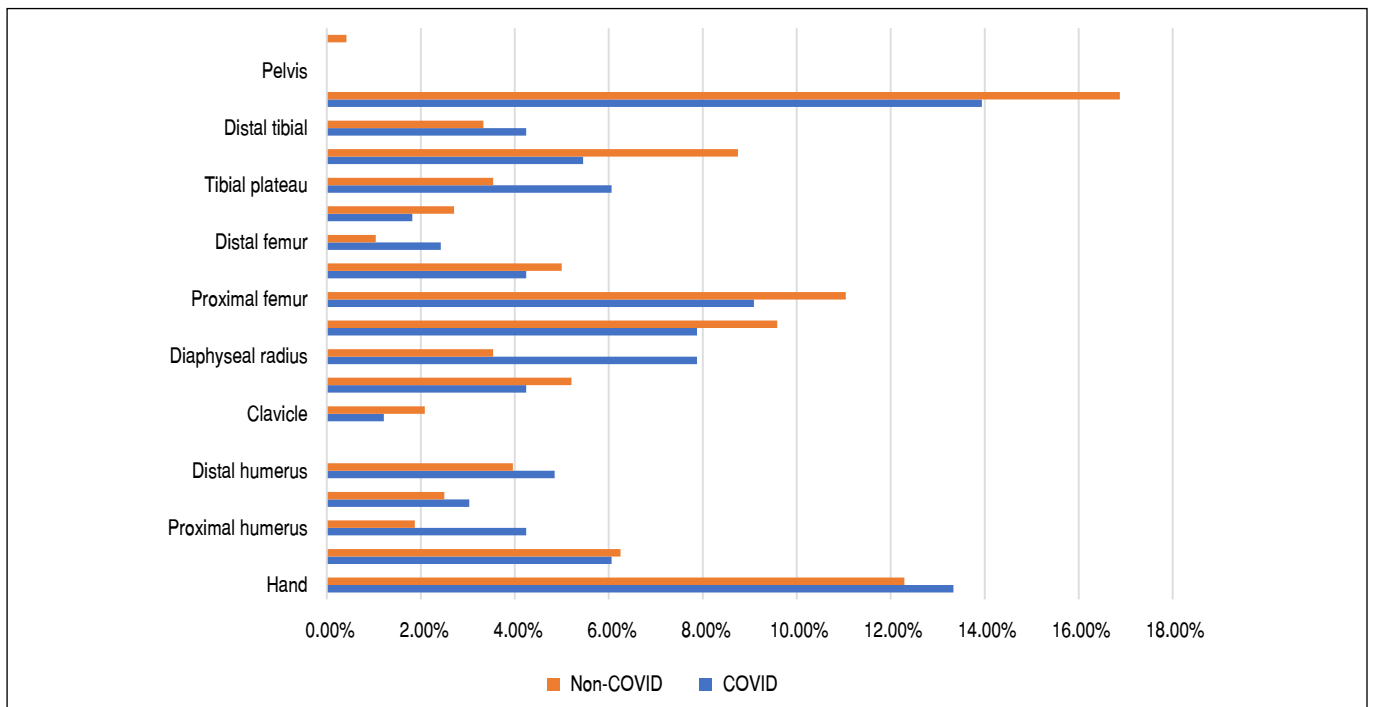
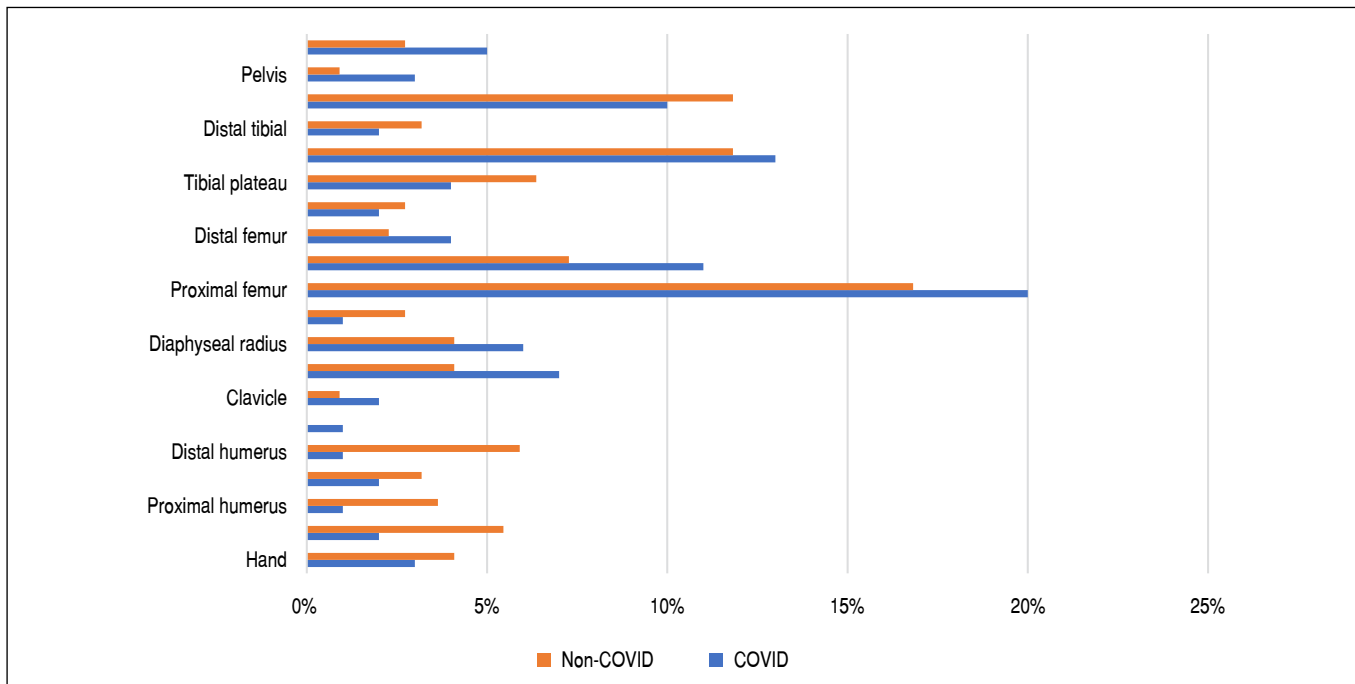


Figure 2. Comparative fractures graph between COVID and non-COVID groups at Hospital Municipal de Barueri Dr. Francisco Moran.



**Figure 3.** Comparative fractures graph between the COVID and non-COVID groups in both hospitals.

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