



# Comparison of the Epidemiological Distribution of Pediatric Fractures Requiring Surgical Intervention: Insights from the COVID-19 Pandemic and Beyond

*Cerrahi Uygulanan Çocuk Travmatik Kırıklarının Covid-19 Pandemisi ve Pandemi Öncesindeki Dönemde Dağılımı*

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## ABSTRACT

**Aim:** The COVID-19 pandemic and its quarantine and isolation measures led to notable differences in trauma mechanisms and their outcomes. This study aims to compare the epidemiological data, fracture patterns, trauma mechanisms, and surgical interventions of pediatric fractures treated surgically during the pandemic with those treated before the pandemic.

**Material and Method:** In this retrospective study, pediatric patients aged 10 years or younger who underwent surgery for fractures during one year before the pandemic and one year during the pandemic were included. The variables analyzed included gender, age, number of children experiencing fracture at home, fracture patterns, mechanisms of injury, injury location, time of injury, and type of surgery performed. The pre-pandemic period was defined as April 2019 – April 2020, and the pandemic period as April 2020 – April 2021.

**Results:** The mean age of patients presenting with fractures before the pandemic was  $6.02 \pm 2.62$  years, compared to  $5.39 \pm 2.48$  years during the pandemic. Before the pandemic, 57.6% (n=38) of the patients presenting with fractures were male, with the most common fracture site being the distal humerus (56.1%, n=37). Falls were the leading mechanism of injury (95.5%, n=63). 40.9% (n=27) of the injuries occurred indoors, and 40.9% (n=27) of the cases were treated with closed reduction and percutaneous pinning (CRPP). During the pandemic, 71.4% (n=40) of the patients were male, with the most common fracture site being the distal humerus (62.5%, n=35). Falls remained the leading mechanism of injury (92.9%, n=52). 48.2% (n=27) of the injuries occurred indoors, and 50% (n=28) of the cases were treated with CRPP. Compared to the pre-pandemic period, the male-to-female patient ratio was higher during the pandemic (p=0.001). Forearm fractures, which typically require higher-energy trauma, were significantly less common during the pandemic (p=0.003).

**Conclusion:** The findings provide insights into the impact of the COVID-19 pandemic on pediatric fractures.

**Key words:** COVID-19 pandemic, pediatric fracture, epidemiology of injury

## ÖZET

**Amaç:** Covid-19 pandemisi ve ardı sıra gelişen karantina ve izolasyon önlemleri, travma mekanizmalarında ve sonuçlarında önemli farklılıklara yol açtı. Bu çalışmanın amacı pandemi sırasında cerrahi olarak tedavi edilen pediatrik kırıkların epidemiyolojik verilerini, kırık tiplerini, travma mekanizmalarını ve cerrahi müdahalelerini pandemiden önce tedavi edilenlerle karşılaştırmaktır.

**Materyal ve Metot:** Bu retrospektif çalışmaya, pandemiden önceki bir yıl ve pandemi sırasında bir yıl boyunca kırık nedeniyle ameliyat edilen 10 ve 10 yaş altı pediatrik hastalar dâhil edildi. Analiz edilen değişkenler arasında cinsiyet, yaş, kırığa maruz kalan çocuğun yaşadığı evdeki çocuk sayısı, kırık tipleri, yaralanma mekanizmaları, yaralanma yeri, yaralanma zamanı ve gerçekleştirilen cerrahi türü yer aldı. Pandemi öncesi dönem Nisan 2019 – Nisan 2020, pandemi dönemi ise Nisan 2020 – Nisan 2021 olarak tanımlandı.

**Bulgular:** Pandemi öncesinde kırık şikâyetiyle gelen hastaların yaş ortalaması  $6,02 \pm 2,62$  yıl iken, pandemi döneminde bu yaş  $5,39 \pm 2,48$  yıldır. Pandemi öncesinde kırık şikâyetiyle gelen hastaların %57,6'sı (n=38) erkekti ve en sık görülen kırık bölgesi distal humerustu (%56,1, n=37). Düşmeler yaralanmanın önde gelen mekanizmasıydı (%95,5, n=63). Yaralanmaların %40,9'u (n=27) iç mekanda meydana geldi ve vakaların %40,9'u (n=27) kapalı redüksiyon ve perkütan pinleme (CRPP) ile tedavi edildi. Pandemi sırasında hastaların %71,4'ü (n=40) erkekti ve en sık görülen kırık bölgesi distal humerustu (%62,5, n=35). Düşmeler yaralanmanın önde gelen mekanizması olmaya devam etti (%92,9, n=52). Yaralanmaların %48,2'si (n=27) iç mekanda meydana geldi ve vakaların %50'si (n=28) CRPP ile tedavi edildi. Pandemi öncesi döneme kıyasla, erkek-kadın hasta oranı pandemi sırasında daha yüksekti (p=0,001). Çoğunlukla daha yüksek enerjili travma sonrası gelişen ön kol kırıkları, pandemi sırasında önemli ölçüde daha az izlendi (p=0,003).

**Sonuç:** Bulgular COVID-19 pandemisinin pediatrik kırıkları üzerindeki etkisine ilişkin fikir vermektedir.

**Anahtar kelimeler:** COVID-19 pandemisi, pediatrik kırık, yaralanmanın epidemiyolojisi

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## Introduction

Pediatric trauma is one of the leading causes of hospital admissions in children across many countries and may result in long-term disabilities<sup>1,2</sup>. Following trauma, children can experience physical limitations, chronic pain, and psychological issues such as post-traumatic stress disorder (PTSD)<sup>3</sup>. These consequences also affect families psychosocially<sup>4</sup>. During pandemic periods, quarantine and isolation measures significantly altered individuals' daily activities<sup>5</sup>. Specifically, home confinement, reduced mobility, and decreased physical activity influenced the types and frequency of orthopedic traumas in both children and adults<sup>5-6</sup>. This led to notable differences in trauma mechanisms and their outcomes<sup>5-6</sup>.

The COVID-19 pandemic began in December 2019 and spread worldwide within months. In Türkiye, the first case was reported on March 11, 2020 (Anadolu Agency, 11.03.2020), followed by a period of home quarantine. While mobility restrictions during the pandemic reduced the spread of the virus, domestic traumas persisted and contributed to distinct morbidities<sup>5-6</sup>. Although the COVID-19 pandemic has ended, pandemics remain a recurring reality in human history. The end of the COVID-19 outbreak does not imply the elimination of future health crises. Factors such as globalization, frequent travel, environmental degradation, and zoonoses continue to increase the likelihood of new pandemics. Studies conducted during such periods will contribute valuable insights for managing future pandemics.

This study aims to compare the epidemiological data of pediatric fractures treated surgically during the pandemic with those treated before the pandemic, to identify differences in fracture patterns, trauma mechanisms, and surgical interventions.

## Methods

This retrospective study was conducted in the Department of Orthopedics and Traumatology at our tertiary care hospital. Pediatric patients aged 10 years or younger who underwent surgery for fractures during one year before the pandemic and one year during the pandemic were included. The variables analyzed included gender, age, number of children at home, fracture patterns, mechanisms of injury, injury location, time of injury, and type of surgery performed. The pre-pandemic period was defined as April 11, 2019, to April 10, 2020, and the pandemic period as April 11, 2020, to April 11, 2021, encompassing one year of home confinement.

Administrative approval from the hospital management and ethical approval from the Gülhane Clinical Research Ethics Committee (reference number: 2024-565) were obtained before the study.

## Statistical Analysis

Data were presented as numbers, percentages, means, standard deviations, medians, minimum, and maximum values. Statistical analysis was performed using IBM Statistical Package for Social Sciences (SPSS) program version 26. Normality of data distribution was assessed using the Kolmogorov-Smirnov test. The Mann-Whitney U test was used for numerical variables, and the Chi-square test for categorical variables. A p-value of  $<0.05$  was considered statistically significant.

## Results

The mean age of patients presenting with fractures before the pandemic was  $6.02 \pm 2.62$  years, compared to  $5.39 \pm 2.48$  years during the pandemic. No significant difference in mean age was found between the groups ( $p > 0.05$ ). The mean number of children at home for patients presenting before the pandemic was  $1.83 \pm 0.82$ , compared to  $2.45 \pm 0.97$  during the pandemic. The increase in the number of children at home during the pandemic was statistically significant ( $p = 0.001$ ) (Table 1).

Before the pandemic, 57.6% ( $n = 38$ ) of the patients presenting with fractures were male, with the most common fracture site being the distal humerus (56.1%,  $n = 37$ ). Falls were the leading mechanism of injury (95.5%,  $n = 63$ ), with 40.9% ( $n = 27$ ) occurring indoors (e.g., home or school), 68.2% ( $n = 45$ ) happening in the evening, and 40.9% ( $n = 27$ ) treated with closed reduction and percutaneous pinning (CRPP).

During the pandemic, 71.4% ( $n = 40$ ) of the patients were male, with the most common fracture site again being the distal humerus (62.5%,  $n = 35$ ). Falls remained the leading mechanism of injury (92.9%,  $n = 52$ ), with 48.2% ( $n = 27$ ) occurring indoors, 64.3% ( $n = 36$ ) in the evening, and 50% ( $n = 28$ ) treated with CRPP. Compared to the pre-pandemic period, the male-to-female ratio was higher during the pandemic ( $p = 0.001$ ). Forearm fractures, which typically require higher-energy trauma, were significantly less common during the pandemic ( $p = 0.001$ ) (Table 2). No statistically significant differences were observed in other characteristics or treatment modalities (Fig. 1).

**Table 1.** Mean and median ages of the patients having fracture according to the groups

	Before Pandemic (n=66)		During Pandemic (n=56)		p*
	Mean $\pm$ SD	Median (Min-Max)	Mean $\pm$ SD	Median (Min-Max)	
Age (Year)	6.02 $\pm$ 2.62	6 (0–10)	5.39 $\pm$ 2.48	2 (0–4)	0.14
Number of children at home	1.83 $\pm$ 0.82	2 (0–4)	2.45 $\pm$ 0.97	2 (1–4)	0.001

\* Mann Whitney U test was used

**Table 2.** Distribution of patients presenting with fracture complaints according to gender, the fracture pattern, trauma type and location and the treatment applied, according to groups formed with those presenting before and during the pandemic

		Before pandemic (n=66)		During pandemic (n=56)		
		n	%	n	%	
Gender					p	
	Male	38	57.6	40	71.4	0.001
	Female	28	42.4	16	28.6	
Fracture pattern						
	Humerus distal	37	56.1	35	62.5	0.46
	Femur	10	15.1	8	14.4	0.63
	Forearm	12	18.2	4	7.1	0.003
	Hand	4	6.1	4	7.1	0.1
	Tibia	3	4.5	5	8.9	0.25
Trauma type						
	Fall	63	95.5	52	92.9	0.7*
	Impact	3	4.5	4	7.1	
Trauma location						
	Indoor (home, school, etc.)	27	40.9	27	48.2	0.42
	Outdoor (park, garden etc.)	39	59.1	29	51.8	
Trauma time						
	Evening (17:00 – 07.59)	45	68.2	36	64.3	0.65
	Morning (08:00 – 16:59)	21	31.8	20	35.7	
Operation type						
	CRPP	27	40.9	28	50.0	0.34
	ORPP	22	33.3	12	21.4	
	TEN	17	25.7	16	28.6	

\* Fisher Test was used, Gray columns: before the pandemic (n=66), Black columns: during the pandemic (n=56), UE: upper extremity, LE: lower extremity.

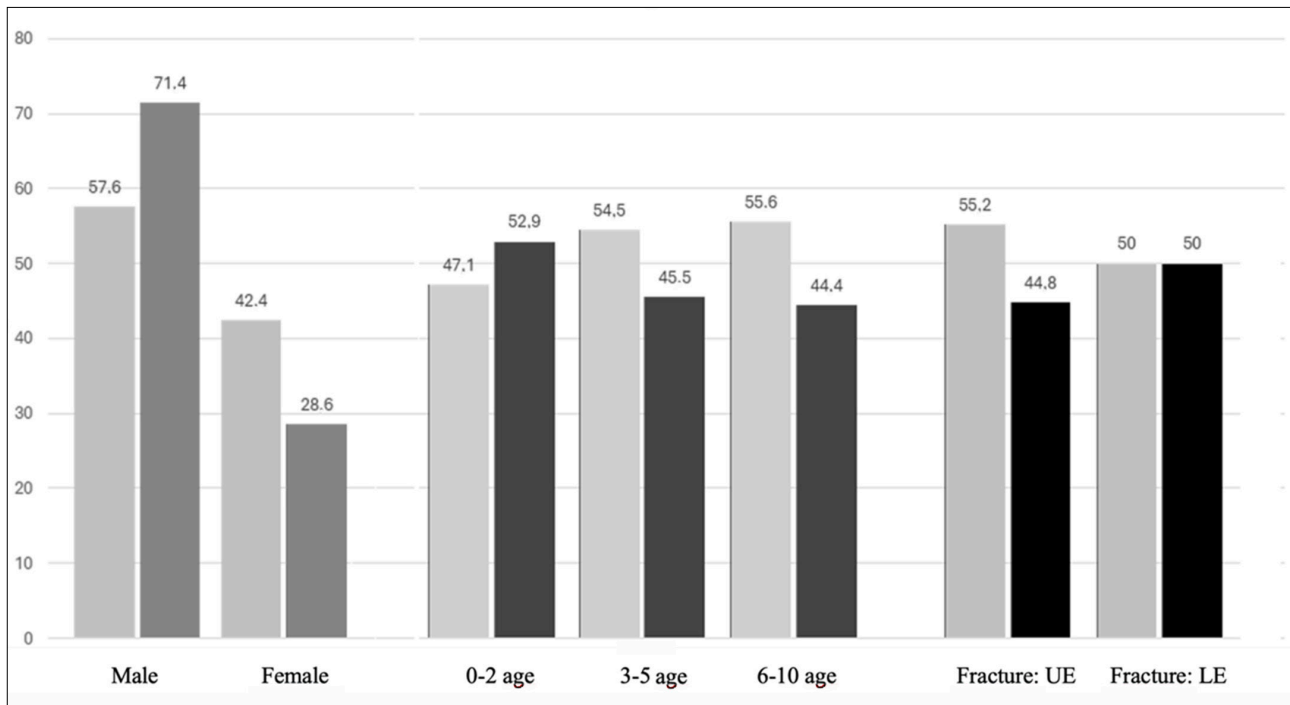
## Discussion

During the COVID-19 pandemic, significant changes occurred in healthcare practices and patient behaviors<sup>7,8</sup>. Although children's outdoor activities decreased due to restrictions, the number of children at home increased significantly. This resulted in more time spent indoors and a corresponding increase in falls and injuries<sup>9</sup>. This study aimed to analyze these patterns using empirical data.

Key findings revealed notable differences in fracture distributions before and during the pandemic. The most frequent fracture type, distal humerus fractures,

was consistent across both periods. These injuries, commonly caused by low-energy trauma such as falls, reflect typical patterns in pediatric populations<sup>9–14</sup>. A notable finding was the decreased incidence of forearm fractures, which usually result from high-energy traumas, during the pandemic<sup>10–13</sup>. This shift likely reflects changes in trauma mechanisms due to reduced outdoor activities and increased time indoors.

Furthermore, the significant rise in the number of children at home during the pandemic was associated with an increased frequency of fractures requiring surgical



**Figure 1.** Evaluation of the patients (in the study groups before and during the pandemic) with fracture complaints according to gender, age ranges, and fracture sites.

intervention<sup>11</sup>. This may be attributed to heightened interaction and physical activity among children within confined spaces. Crowded living conditions, especially in smaller homes, increase the risk of accidental injuries, such as falls or collisions during play. Additionally, parents may find it more challenging to supervise multiple children simultaneously, making accidents harder to prevent and detect.

Regarding trauma mechanisms, falls were the predominant cause of injuries in both periods<sup>11,14–16</sup>. However, the increase in indoor injuries during the pandemic underscores the need for enhanced safety measures at home. Educating parents on injury prevention and providing safe play areas are essential interventions<sup>17</sup>.

In terms of timing, most injuries in both periods occurred in the evening, likely reflecting children's activity patterns and family routines.

The findings of this study also underline the broader implications of the COVID-19 pandemic on pediatric orthopedic care, highlighting not only the shifts in injury patterns but also potential changes in healthcare accessibility and resource allocation. The increased proportion of indoor injuries observed during the pandemic may reflect limited opportunities for outdoor activities and recreational sports, which typically contribute to higher-energy trauma cases such as forearm

fractures. This shift emphasizes the importance of targeted injury prevention strategies, particularly within the home environment. Moreover, the rise in male-to-female ratios during the pandemic could be attributed to gender-based differences in activity levels or supervision patterns within households. Future research should explore these sociocultural dynamics further, as understanding such factors could guide public health interventions during future crises. Additionally, while this study focused on surgically treated fractures, it is likely that the pandemic also impacted the prevalence and management of less severe pediatric injuries, which warrants further investigation to capture the pandemic's effect on pediatric trauma care fully.

### Limitations

This study's limitations include a relatively small sample size (66 patients pre-pandemic and 56 during the pandemic), which may limit statistical power and generalizability. Additionally, the accuracy of recorded variables such as trauma location and timing could be influenced by recall bias. The lack of long-term follow-up data is another limitation. Future multi-center studies from different geographic regions would enhance the reliability and applicability of these findings.

## Conclusion

The findings of this study provide valuable insights into the impact of the COVID-19 pandemic on pediatric fractures. For pediatric orthopedic practice, these results highlight the importance of developing specific preventive measures for managing indoor injuries during similar crises. Parents should plan indoor activities carefully to ensure safety, while healthcare providers should focus on education and awareness programs.

Future research should explore the long-term effects of pediatric fractures, treatment processes, and effective strategies for injury prevention in the post-pandemic era.

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