



Changes in Pediatric Trauma During the COVID-19 Pandemic; Does the Pandemic Have an Effect on the Severity of Traumas?

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ABSTRACT

Aim: Traumas are the most common cause of mortality and morbidity in children. Coronavirus disease-2019 (COVID-19) was shown to affect pediatric mental health, child neglect, and the occurrence of traumatic injuries. This study aimed to characterize pediatric trauma cases presenting to our institution before and after the pandemic began.

Materials and Methods: Patients with trauma who were admitted to our emergency department between March, 2019 and March, 2021 were included. The patients were classified into two groups as before and after the pandemic began (March, 2020). Trauma characteristics, the severity of the injury, and prognosis were assessed. The patients' injury severity scores (ISS) and pediatric trauma scores (PTS) were noted.

Results: A total of 1,718 patients were included in this study. The number of pediatric trauma admissions dropped from 1,039 to 679 after the pandemic started. There was no difference between these groups in terms of age ($p=0.874$) or gender ($p=0.106$). There was a significant decrease in the number of traumatic injuries ($p<0.001$) especially during the first shutdown period (April, May, and June, 2020). Additionally, there was a significant increase in terms of foreign body aspiration ($p=0.001$) and pedestrian injuries ($p=0.016$). Although a significant increase was noted in the ISS of the patients ($p<0.001$), no differences were found between the PTSs ($p=0.075$) or multi-organ injuries ($p=1.000$). Also, no significant differences were observed regarding mortality ($p=0.650$), household accidents ($p=0.600$), trauma type ($p=0.533$), the need for transfusion ($p=0.166$), surgery ($p=0.077$) or mechanical ventilation ($p=0.464$) between the two groups.

Conclusion: The COVID-19 pandemic altered social patterns, leading to a decrease in pediatric traumas. This decrease was most prominent during the shutdown period. The variables showing severe trauma, such as the need for surgery, did not change despite a significant increase in ISS. This was attributed to a decrease in admissions for minor trauma.

Keywords: Trauma, ISS, COVID-19, pediatrics, lockdown

Introduction

The infections of the Coronavirus disease-2019 (COVID-19) began in December, 2019 in Wuhan, China. In March, 2020, the World Health Organization declared COVID-19 a global pandemic (1). The first case in Turkey was reported on March 10th, 2020. Later, restrictions were put in place,

such as "stay at home" orders and a ban on children and adolescents under the age of 20 leaving their homes after April 4th, 2020 (2).

The COVID-19 pandemic significantly impacted childhood trauma in several ways. During the early stages of the pandemic, there was a significant decrease in emergency

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Received: 31.07.2023 Accepted: 28.08.2023



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department (ED) visits across all age groups due to a fear of exposure to the virus, government restrictions, and stay-at-home orders (3-5). However, it is important to note that while overall ED visits declined, the severity of medical conditions among pediatric patients who did present to the ED increased (6). Moreover, the pandemic also resulted in changes in behavior and mobility patterns, which may have affected the types of pediatric injuries. With children spending more time at home, there may be an increase in home-related injuries such as burns, falls, and choking. At the same time, there may be a decrease in injuries related to outdoor activities, such as sports-related injuries.

We, therefore, hypothesized that the rate of pediatric trauma admissions, hospitalization patterns, and the mechanisms of trauma differed before and during the pandemic. This study aimed to retrospectively evaluate the changes in mechanisms and outcomes among the pediatric trauma population during the COVID-19 pandemic.

Materials and Methods

After the ethical approval of the University of Health Sciences Turkey, İzmir Tepecik Training and Research Hospital Clinical Research Ethics Committee (2021/03-09), the medical records of trauma patients were retrospectively reviewed. This study was conducted over 2 years (March, 2019 to March, 2021) at a large urban tertiary center. All children (0-18 years old) who were admitted to the ED because of trauma and who consulted with our clinic were included. Those patients with incomplete medical records were excluded.

The patients were divided into two groups. Those patients who applied before the COVID-19 pandemic formed Group A. Patients who applied during the pandemic formed Group B. The demographic data of the patients were examined. Application month, time, and type of transport to the center (direct or in an ambulance) were evaluated. The mechanism of the trauma and the affected organs were assessed. The patients' injury severity scores (ISS) and pediatric trauma scores (PTS) scores were noted. The groups were compared in terms of the following parameters: hospitalization time, mechanical ventilation needs, consultations, surgery, and prognosis.

All pre-structured forms were collected, and the data were transferred into the Excel 2010 (Microsoft, Redmond WA, USA) format. Normally distributed data were reported as means \pm standard deviations. The statistical significance between normally distributed data for different groups was calculated with the independent samples t-test.

Non-normally distributed data were reported as medians (quartiles and ranges). The statistical significance between non-normally distributed data for different groups was calculated with the non-parametrical Mann-Whitney U test. Pearson's chi-squared, Yates' continuity correction and Fisher's exact test were used to calculate statistical significance between frequencies. Significance was set at $p < 0.05$. All statistical tests were performed using IBM SPSS Statistics 21.0 (IBM Corp., Armonk, NY, USA).

Results

A total of 1,718 children presented to our clinic due to trauma during the study period. The 659 patients (Group B) in 2020-2021 represented a 35% decrease in overall volume compared to the 1,039 patients (Group A) in 2019-2020. The greatest decrease in patient volumes was 70.1% between April, 2020 and June, 2020 (278 versus 83 patients, respectively) ($p < 0.001$) (Figure 1).

There was no significant difference in median ages and sex distribution between the groups ($p < 0.106$, $p < 0.106$). Most of the patients ($n = 506$, 29.4%) were admitted to the hospital for foreign body ingestion. Fifty-nine patients (3.4%) were admitted for foreign body aspiration, 329 (19.2%) patients were admitted for corrosive ingestion, and 109 patients (6.3%) were admitted for penetrating injuries (gunshot wounds, stab wounds, or other). There was no significant difference between the groups in the terms of injury types resulting from vehicle traffic accidents, falls from height, bicycle accidents, corrosive substance intake, crushes, genital traumas, or foreign body ingestion. Although the percentage of patients with foreign body aspiration ($p = 0.001$) and pedestrian trauma ($p = 0.016$) increased, the percentage of patients with penetrating injuries ($p = 0.014$) decreased statistically significantly during

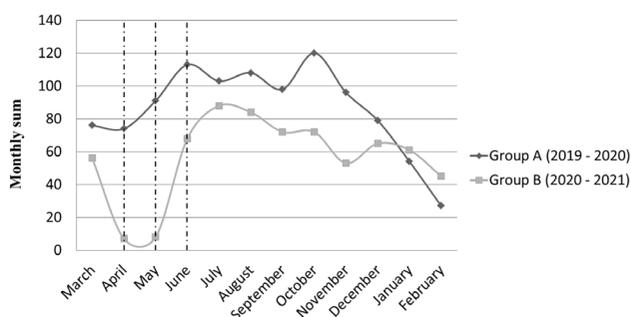


Figure 1. Volume of admissions by month. Group A comprised pre-pandemic applicants (March 2019-2020), while Group B consisted of post-pandemic applicants (March 2020-2021). Notably, the relative proportions from April to June experienced a significant decrease from 2019 to 2020 (278 versus 83 patients, respectively) ($p < 0.001$)

the pandemic. In terms of transport type to the hospital, the percentage of admission by ambulance decreased significantly during the pandemic ($p<0.001$). The time of admission rates decreased between 8 a.m. and 4 p.m. during the pandemic period and increased between midnight and 8 a.m. ($p<0.001$). There was no difference between the groups in terms of the rates of patients with organ or multisystem injuries at admissions (Table I).

ISS and PTS were used to determine the trauma severity of the cases. ISS was significantly higher during the pandemic ($p<0.001$). When the ISS subgroups were detailed, it was found that there was a decrease in the incidence of minor traumas (ISS=0 to 8) and an increase in the incidence of serious traumas (ISS=25 to 49) during the pandemic. There was no statistically significant difference in PTS between the two groups (Table II).

Although hospitalization rates increased during the pandemic ($p<0.001$), hospital length of stay (LOS) was similar in the pre-pandemic and pandemic periods ($p=0.665$). There was no significant difference in the terms of operation rates ($p=0.770$) or the admission-operation time interval between the groups ($p=0.904$). The intensive care unit (ICU) rate ($p=0.200$) was similar between the two groups. Although ICU LOS was longer in the pandemic group ($p=0.003$), there was no significant difference in the terms of intubation rates ($p=1.000$), mechanical ventilation times ($p=0.783$), or mortality rates ($p=0.650$) between the groups. The outcomes of the patients are summarized in Table III.

Table I. Demographic characteristics of patients

		Group A (n=1039)	Group B (n=679)	p-value
Median age, n (%)	Year (Q1-Q3)	4 (2-9)	4 (2-9)	0.874
Sex	Male (%)	651 (62.7)	399 (58.8)	0.106
Injury subgroups, n (%)	Motor vehicle collision	23 (2.2)	12 (1.8)	0.641
	Pedestrian	77 (7.4)	73 (10.8)	0.016
	Bicycle accident	54 (5.2)	46 (6.8)	0.172
	Fall	220 (21.2)	131 (19.3)	0.344
	Crush	43 (4.1)	22 (3.2)	0.340
	Penetrating injury (gunshot wounds, stab wounds, or other)	78 (7.5)	31 (4.6)	0.014
	Genital trauma	12 (1.2)	2 (0.3)	0.058
	Foreign body ingestion	313 (30.1)	193 (28.4)	0.450
	Foreign body aspiration	23 (2.2)	36 (5.3)	0.001
Corrosive ingestion	196 (18.9)	133 (19.6)	0.710	
Transport type, n (%)	With ambulance	290 (27.9)	132 (19.4)	<0.001
	Direct admission	749 (72.1)	547 (80.6)	
Admission to E.R. time (o'clock), n (%)	0-8	87 (8.4)	146 (21.5)	<0.001
	8-16	310 (29.8)	108 (15.9)	
	16-24	642 (61.8)	425 (62.6)	
Injuries, n (%)	None	541 (52.1)	359 (52.9)	0.745
	Multisystem injury	21 (2)	13 (1.9)	1.000
	Other	477 (45.9)	307 (45.2)	0.777

E.R.: Emergency Room

Table II. Severity of trauma

	Group A (n=1039)	Group B (n=679)	p-value
ISS: median (Q1-Q3)	0 (0-1)	1 (0-4)	<0.001
Minor (ISS=0-8)	965 (92.9%)	581 (85.6%)	<0.001
Moderate (ISS=9-15)	51 (4.9%)	47 (6.9%)	0.079
Serious (ISS=16-24)	6 (0.6%)	32 (4.7%)	<0.001
Severe (ISS=25-49)	15 (1.4%)	15 (2.2%)	0.319
Critical (ISS=50-75)	2 (0.2%)	4 (0.6%)	0.221
PTS: median (Q1-Q3)	11 (10-11)	11 (10-11)	0.075

Table III. Outcome			
	Group A (n=1039)	Group B (n=679)	p-value
Hospitalized Hospital, LOS, days: median (Q1-Q3)	216 (20.8%) 3 (1-4)	195 (28.7%) 3 (1-4)	<0.001 0.665
Operated Admission-operation time interval, hours: median (Q1-Q3)	106 (10.2%) 4 (2-10)	88 (13%) 4 (1.5-10)	0.770 0.904
ICU ICU, LOS, days: median (Q1-Q3)	17 (1.6%) 3 (2-5)	18 (2.7%) 6 (3-11)	0.200 0.003
Intubated Mechanical ventilation, LOS, days: median (Q1-Q3)	11 (1.1%) 1 (1-2)	8 (1.2%) 1 (1-4.5)	1.000 0.783
Mortality	2 (0.2%)	2 (0.3%)	0.650

Discussion

The COVID-19 pandemic had a profound impact on childhood trauma in various aspects (3-5). Additionally, the pandemic led to alterations in behavior and mobility patterns, potentially influencing the nature of pediatric injuries. The social transformations imposed by COVID-19 had consequences for pediatric mental health, child neglect, and the occurrence of pediatric traumatic injuries (7,8). Within our extensive study, we observed variations in pediatric trauma trends, injury patterns, and injury severities throughout the COVID-19 pandemic.

During the COVID-19 lockdowns, there was a notable reduction in ED visits and hospital admissions, as is evident from systematic reviews in the literature (3,9). In our study, we observed a decrease in the number of patients admitted due to traumatic injuries. The months of March to June, 2020, characterized by curfew periods and stringent restrictions, experienced the most significant decline in trauma cases. Even with the relaxation of restrictions during the summer, the number of applications did not return to pre-pandemic levels. Also, many individuals chose to directly seek hospital care without utilizing ambulances. These trends can be attributed to various factors, including policies aimed at ensuring hospitals were not overwhelmed and could maintain uninterrupted health services, and also by promoting social isolation to mitigate the risk of contracting COVID-19, and the implementation of stay-at-home policies. These measures, particularly in children, contributed to a substantial decrease in the incidence of traumas. In our study, no significant differences in age and gender were observed between the pre-pandemic and pandemic periods. However, it was noted that traumas were more prevalent among boys in both groups, with the median age group being 4 years old for both periods.

The existing literature indicates that approximately 91% of unintentional injuries take place within or near the

child's home, and it has been determined that preschool children make up 55% of the victims of home accidents. Injuries resulting from accidents remain the leading cause of morbidity and mortality among children. Among the various types of injuries, the most common ones include ingesting foreign bodies, poisoning, falls, drowning, and burns (10). In order to gain a comprehensive understanding of the mechanisms behind trauma, we categorized injuries into specific subgroups, including motor vehicle collisions, pedestrian incidents, bicycle accidents, falls, crush injuries, penetrating injuries (such as gunshot wounds, stab wounds, or other types), foreign body ingestion, foreign body aspiration, and corrosive ingestion. The reason for these subdivisions is due to the limited number of studies available which specifically examine the impact of the COVID-19 pandemic on pediatric trauma mechanisms and outcomes. By delving into these distinct categories, we aimed to shed light on the diverse effects of the pandemic on pediatric traumas (11). Numerous studies have demonstrated elevated rates of domestic injuries, with some indicating higher occurrences during the pandemic compared to the pre-pandemic period (12,13). In our analysis of specific subgroups, we observed an increase in incidents related to pedestrians, bicycle accidents, foreign body aspiration, and corrosive ingestion. Surprisingly, contrary to expectations based on the existing literature, we found that the number of pedestrian injuries and bicycle crashes did not decrease proportionally during the pandemic, but instead showed an opposite trend (8). These findings highlight the complex and potentially unexpected effects of the pandemic on specific types of injuries within the domestic setting.

The implementation of social distancing measures and stay-at-home orders inadvertently resulted in prolonged periods spent at home where children, with or without adult supervision, may be more prone to swallowing or aspirating foreign objects. In our study, we observed an increase in cases of foreign body aspiration and corrosive ingestion.

Notably, foreign body ingestion emerged as the most common reason for hospital admission in both groups. While there was a decrease in the number of patients seeking medical attention for this reason during the pandemic period, this decline was not statistically significant. Reports indicate that these accidents predominantly occur within the home setting, regardless of family supervision (10,14). Moreover, a previous study highlighted an increase in domestic accidents, particularly in relation to foreign body ingestion (12). During the pandemic period, there was also a decrease in motor vehicle collisions, falls, crush injuries, and penetrating injuries. These types of injuries are typically more common outside the home and tend to affect children older than 6 years. Thus, it can be inferred that stay-at-home policies effectively reduced the risk of trauma exposure for children.

As our hospital does not have a burns unit, we did not encounter any patients presenting with burns during the study period. Furthermore, due to the retrospective nature of this study, we were unable to specifically investigate cases of suspected abuse. However, one study conducted in the United States reported a concerning increase in child abuse cases (15). Considering that children may experience increased loneliness and vulnerability to abuse while staying at home, exacerbated by heightened stressors and prolonged time spent indoors, healthcare professionals should maintain a high level of suspicion regarding abuse or neglect. It is imperative that public health units thoroughly evaluate the implications of school closures, and health policies should be tailored accordingly to address these concerns.

In a single-center study examining admission times for pediatric patients with trauma over a 16-year period, it was observed that the busiest admission times occurred in the afternoon, while nighttime admissions decreased (16). Similarly, prior to the pandemic, this pattern was observed in our country as well. However, during the pandemic, daytime admissions decreased as children who spent more time at home with their mothers were less likely to experience trauma. Conversely, night-time admissions increased as families preferred hours when the emergency room density was lower.

Furthermore, there was a decrease in the number of patients presenting with multiple system injuries. However, interestingly, the overall number of children presenting to the hospital did not change, despite the absence of any injury. This suggests that families' concerns about potential trauma outweighed their fear of the pandemic, prompting

them to seek medical attention for their children even in the absence of actual injuries.

The ISS serves as a valuable measure to assess the severity of injuries, particularly in patients with multiple traumas (17). In 1987, Tepas et al. (18) introduced the PTS with the aim of swiftly and accurately evaluating injured children during field triages. The PTS is a scoring system specifically developed for children. Notably, the developers discovered a statistically significant linear relationship between PTS and ISS, further emphasizing the utility of the PTS in predicting injury severity.

Our study revealed no significant differences between the ISS and PTS scores among the groups. This finding aligns with those results observed in previous studies within the literature, which also did not report significant variations in ISS scores (11,19). However, upon further examination of the ISS scores, we observed a decrease in minor traumas and an increase in the rates of severe traumas. Notably, with an increasing number of patients classified as experiencing serious trauma, particularly those with ISS scores ranging from 16 to 24, a higher proportion of patients were admitted to the hospital and required intensive care when compared to the pre-pandemic group.

It was also noteworthy that during the pandemic, a significant majority of those patients who sought hospital care, regardless of the reason, presented with severe clinical conditions. Another study examining rates of appendicitis admissions in our hospital reported a significant increase in the number of patients presenting with complicated appendicitis (20). This may be attributed to the heightened fear of contracting illnesses in hospital settings, resulting in longer delays in seeking medical attention. Consequently, those cases who presented to the hospital during the pandemic tended to be in more severe conditions and thus required hospitalization.

In our study, we observed that the duration of hospital stays remained unchanged, while the hospitalization rates increased. While only one study reported reduced lengths of stay for pediatric traumas during the pandemic, suggesting efficient resource utilization, other studies indicated an increase in hospitalization rates during this period (11,21). Furthermore, no significant differences were found in the number of operations, the time interval between admission and operation, or the need for mechanical ventilation and intubation. These findings underscore the importance of maintaining adequate reserves in pediatric ICUs (PICUs) and operating theaters at level 1 trauma centers. Despite the impact of the COVID-19 pandemic on pediatric traumas, there was no observed change in mortality rates.

Study Limitations

Our study was subject to certain limitations which should be acknowledged. Firstly, being a retrospective review of electronic medical records, there was a possibility of reporting errors and inaccuracies in the recorded information. To minimize this potential bias, we conducted individual chart reviews instead of relying solely on ICD-10 codes. However, the inherent limitations of retrospective studies still apply. Secondly, we did not specifically investigate the socioeconomic status of the families or the number of individuals residing in each household, which can potentially contribute to the occurrence of home accidents. Understanding these factors could provide further insights into the rates and patterns of injuries within the home setting. Despite these limitations, our analysis is consistent with previous retrospective reports which have described changes in traumatic injuries during stay-at-home measures in Turkey. While we recognize the need for further research to address these limitations and provide a more comprehensive understanding, our study contributes to the existing body of evidence on the impact of stay-at-home precautions on traumatic injuries.

Conclusion

The COVID-19 pandemic and its related policies, including hospital management strategies, social isolation measures, and stay-at-home policies, effectively reduced pediatric trauma cases by altering social patterns. In order to promote child safety, it is crucial to secure dangerous objects, address home accident risks, and educate families regarding abuse and neglect, given the fluctuating mental states at home. Healthcare professionals should approach these issues cautiously and be vigilant in detecting potential cases. The efficient utilization of hospital resources is crucial during pandemics, considering the increase in severe clinical presentations while maintaining a steady number of surgical interventions and intensive care cases.

Ethics

Ethics Committee Approval: Ethical approval was obtained from the University of Health Sciences Turkey, İzmir Tepecik Training and Research Hospital Clinical Research Ethics Committee (2021/03-09).

Informed Consent: The medical records of trauma patients were retrospectively reviewed.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: B.T.K., E.B.Ç.K., M.O.Ö., Design: B.T.K., E.B.Ç.K., Data Collection or Processing: D.S., A.N., Analysis or

Interpretation: D.S., B.T.K., E.B.Ç.K., Literature Search: D.S., A.N., Writing: D.S., B.T.K.

Conflict of Interest: The authors have no relevant financial or non-financial interests to disclose.

Financial Disclosure: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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