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Original Article

Traumatic injuries in children during COVID-19 pandemic: a national report from northern Iran

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Abstract: Background: There are no comprehensive and accurate statistics on epidemiology and clinical features, especially during the COVID-19 period. The present study tries to describe the pediatric traumas in a referral treatment center in northern Iran during the COVID-19 period and to compare the available statistics with the years before pandemics to examine the differences in the epidemiology of this event in our country. Methods: This cross-sectional study was performed on 543 children under 15 years admitted to this hospital due to different types of traumas in the first six months of 2019 (before the COVID-19 pandemic) and the first six months of 2020 (coinciding with the peak of the pandemic). The information was retrospectively collected by reviewing the hospital recorded files and the trauma-specific hospital information system. Results: In total, 436 children were referred before the COVID-19 pandemic period and 107 within the pandemic outbreak. The peak age of patients admitted was 2 to 6 years (32.0%) and 70.5% were male. Most of the pointed children had normal weight. The most common mechanism of trauma before and during the COVID-19 pandemic was falling from a height (46.3% versus 42.1%), followed by road accidents (35.6% versus 36.4%). The overall prevalence of penetrating trauma was 6.9% and 9.3%. The most common body sites affected were the head and neck (32.1%) followed by extremities (before the COVID-19 period) and extremities (29.0%) followed by the head and neck (24.3%) (in the COVID-19 period). The overall rates of multiple trauma before and within the pandemic were also 35.6% versus 35.5%. In children aged 12 to 15 years, road accidents were more reported during the COVID-19 pandemic period (68.4% versus 50.9%) and contrarily falling from a height more before the pandemic (25.5% versus 0.0%). In children under two years of age, head and neck trauma was more reported before the COVID-19 period than in the COVID-19 period (55.6% versus 35.5%), while at this age, limb trauma was more common during the COVID-19 period than before (5.6% versus 20.8%) (P = 0.043). In lean children, abdominal and pelvic trauma were mainly seen in the COVID-19 period (28.6% versus 2.6%) (P = 0.035). Conclusion: Referrals of children from traumatic injuries decreased during the COVID-19 period. However, the main differences in the mechanism of trauma and the type and severity of traumatic injuries to children in this period emphasize the provision of specific guidelines for trauma management in children.

Keywords: Trauma, COVID-19, pediatrics

Introduction

Traumatic events are now identified as one of the most frequent causes of morbidity and mortality in the pediatric population whole over the world [1, 2]. Trauma is the cause of death in half of the children leading to 12,000 deaths along with millions of reversible or persistent disabilities within childhood, leading to heavy cost loads on societies [3]. The main causes of childhood trauma include accidents, bullying, chaos or dysfunction in the house (such as domestic violence, a parent with a mental illness, substance abuse or incarcerated), and physical abuse or neglect [4]. According to recent reports, up to 12% of the patients admit-

ted to pediatric intensive care units experienced the sequels of trauma, leading to poor prognosis in a notable of patients [3]. Despite the rapid expansion of the outbreak of traumatic events among children, especially in developing countries, such patients remain a less studied group [5-7].

Additionally, due to the lack of enough knowledge about the epidemiological and managerial aspects of childhood trauma, its management remained a challenge. This subject is more critical if the patients exposed to prolonged hospitalization and its related complications [8]. The various factors affecting pediatric trauma patients' epidemiology may differ from that of adults, so it is essential to study this unique group separately. In fact, the guidelines and standards for managing trauma in children are entirely different compared to adults [9, 10].

Such a difference seems to be more highlighted during a global pandemic such as the COVID-19 pandemics. The outbreak of COVID-19 pandemic has caused fundamental changes in the infrastructure of health centers, the attitude of the health system towards patient management, the triage and admission of patients, especially in intensive care centers, and finally, the treatment of patients [11].

Trauma childcare centers, are no exception. In other words, there have been significant reports of differences in admission, care, and overall management of children with trauma during the COVID-19 pandemic worldwide, and such changes in the management of these patients could affect treatment outcomes as well [12-14]. Nevertheless, in our country, despite the high statistics of accidents and traumatic events among children, there are no comprehensive and accurate statistics on the epidemiology and clinical features of these children, especially during the COVID-19 period.

The present study tries to describe the pediatric traumas in a referral treatment center in northern Iran during the COVID-19 period and to compare the available statistics with the years before pandemics to examine the differences in the epidemiology of this event in our country.

Methods and material

Study design

This cross-sectional study was conducted in 2019-2020 in Poursina hospital, Rasht city, Iran. The study protocol was approved by the ethics code of IR.GUMS.REC.1400.169. Poursina teaching hospital is the referral center for trauma and road accident patients in Iran northern Iran, admitting thousands of trauma cases of different ages, mainly caused by road accidents, per year.

Inclusion and exclusion criteria

This cross-sectional study was performed in 2019-2020. The inclusion criteria were age lower than 15 years, having traumatic events of any kind in January-June 2019 (before the COVID-19 pandemic) and January-June 2020 (coinciding with the peak of the pandemic), having full hospital documents and signing the written informed consent by the parents to participate in this study. The exclusion criteria were incomplete data and lack of consent. We included all eligible cases regardless of their past medical/surgical histories.

We considered children as individuals younger than 15 years, according to the study of Harausz and colleagues in 2018, and based on the standardized National Center for Health Statistics (NCHS)/Centers for Disease Control (CDC) growth charts [15, 16].

The patients' information was retrospectively collected by reviewing the hospital recorded files and the hospital information system, especially the trauma-specific hospital information system.

Data collection

The data collected included: 1. Demographic characteristics. 2. Anthropometric parameters. 3. The causes and mechanisms of trauma. 4. The anatomy of injured sites. 5. Time of admission and discharge.

The study endpoint was to assess and compare different epidemiological and clinical aspects of childhood traumatic events between COVID-19 outbreak area and before.

These were the study indicators and were collected by checklist from hospital documents.

Table 1. Baseline characteristics of study population

Age subgroups	Number (%)
Less than 2 years	78 (14.4%)
2 to 6 years	174 (32.0%)
7 to 12 years	162 (29.8%)
13 to 15 years	129 (23.8%)
Gender	
Male	383 (70.5%)
Female	160 (29.5%)
Body mass index	
Less than 18.5 kg/m^2	45 (8.3%)
19 to 25.9 kg/m^2	395 (73.3%)
26 to 29.9 kg/m^2	90 (16.6%)
≥ 30 kg/m^2	10 (1.8%)
Time of admission	
Before COVID-19 pandemic	436 (80.3%)
Within COVID-19 pandemic	107 (19.7%)
Mechanisms of trauma	
Falling from a height	247 (45.5%)
Accidents	194 (35.7)
Quarrel	13 (2.4%)
Sport trauma	18 (3.3%)
Cutting	31 (5.7%)
Drowning	5 (0.9%)
Others	35 (6.4%)
Type of trauma	
Penetrating	40 (7.4%)
Blunt	503 (92.6%)
Site of trauma	
Head and neck	166 (30.6%)
Chest	13 (2.4%)
Abdomen and pelvic	18 (3.3%)
Spinal column	9 (1.7%)
Extremities	144 (26.5%)
Multiple trauma	193 (35.5%)

Statistical analysis

The quantitative variables were presented as mean ± standard deviation and categorical parameters as number (percentage). The quantitative data of trauma at the different time points were assessed by t-test or Man-Whitney U test and the qualitative variables by the Chi-Squares test. *P* values of ≤ 0.05 were considered statistically significant. For the statistical analysis, the statistical software SPSS version 23.0 for windows (IBM, Armonk, New York) was used.

Results

Study population

Within the study periods, overall, 543 children suffering from traumatic sequels were referred to our hospital. The ratio of boys to girls was 2.39. The details of baseline characteristics and age distribution are summarized in **Table 1**. The peak age of patients admitted was 2 to 6 years (32.0%) and 70.5% were male. Most of the pointed children had normal weight and only 1.8% of cases were obese. In total, 436 children were referred before the COVID-19 pandemic period and 107 within the pandemic outbreak.

Trauma information

Regarding the mechanism of trauma, falling from a height was reported as the most typical cause of trauma (45.5%), followed by road accidents (35.7%). Most traumas were blunt (92.6%) and only 7.4% were penetrating. The head and neck were the most common trauma sites (30.6%) followed by extremities (26.5%). In total, multiple traumas were reported in 35.5% of children.

Comparing characteristic of pediatric-related trauma before and during the COVID-19 pandemic (**Table 2**) showed no difference in mechanisms of trauma (P = 0.409), type of trauma (P = 0.382) and location of trauma (P = 0.182). In this regard, the most common mechanism of trauma before and during COVID-19 pandemic was falling from a height (46.3% versus 42.1%) followed by road accidents (35.6% versus 36.4%).

Prevalence of trauma

The overall prevalence of penetrating trauma was 6.9% and 9.3%. The most common body sites affected were the head and neck (32.1%) followed by extremities (before the COVID-19 period) and extremities (29.0%) followed by the head and neck (24.3%) (in the COVID-19 period). The overall rates of multiple traumas before and within the pandemic were also 35.6% versus 35.5%.

Comparisons

Comparing the mechanism of trauma between the two study periods according to patients' age showed that road accidents were more reported during the COVID-19 pandemic period

Table 2. Characteristics of trauma before and after COVID-19 pandemic

Item	Before pandemic	Within pandemic	*P* value
Mechanisms of trauma			0.409
Falling from a height	202 (46.3)	45 (42.1)	
Accidents	155 (35.6)	39 (36.4)	
Quarrel	10 (2.3)	3 (2.8)	
Sport trauma	16 (3.7)	2 (1.9)	
Cutting	21 (4.8)	10 (9.3)	
Drowning	3 (0.7)	2 (1.9)	
Others	29 (6.7)	6 (5.6)	
Type of trauma			0.382
Penetrating	30 (6.9)	10 (9.3)	
Blunt	406 (93.1)	97 (90.7)	
Site of trauma			0.182
Head and neck	140 (32.1)	26 (24.3)	
Chest	8 (1.8)	5 (4.7)	
Abdomen and pelvic	12 (2.8)	6 (5.6)	
Spinal column	8 (1.8)	1 (9.0)	
Extremities	113 (25.9)	31 (29.0)	
Multiple trauma	155 (35.6)	38 (35.5)	

Table 3. The multivariable logistic regression model to determine the difference between pre-COVID-19 and COVID-19 periods in mechanisms of trauma

Item	*P* value	OR	95% CI for OR	
			Lower	Upper
Time period	0.078	1.529	0.953	2.454
Gender	0.687	1.089	0.720	1.645
Age	0.000	2.493	2.024	3.069
BMI	0.505	0.893	0.640	1.245
Determinants of types of trauma				
Item	*P* value	OR	95% CI for OR	
			Lower	Upper
Time period	0.355	0.701	0.330	1.489
Gender	0.537	0.797	0.388	1.638
Age	0.533	0.899	0.642	1.258
BMI	0.385	1.310	0.712	2.408
Determinants of sites of trauma				
Item	*P* value	OR	95% CI for OR	
			Lower	Upper
Time period	0.355	0.701	0.330	1.489
Gender	0.537	0.797	0.388	1.638
Age	0.533	0.899	0.642	1.258
BMI	0.385	1.310	0.712	2.408

(68.4% versus 50.9%) and contrarily falling from a height more before the pandemic (25.5% versus 0.0%) in children aged 12 to 15 years (P = 0.033). No difference was revealed in trauma mechanisms between the two time periods adjusting for other age subgroups. The difference in trauma mechanisms between the periods remained insignificant, adjusting gender and body mass index. According to multivariable logistic regression modeling and with baseline characteristics (**Table 3**), no difference was revealed in trauma mechanisms between the two periods of study. The comparison of the types of traumas between the periods before and within COVID-19 showed that blunt trauma was reported more before the CXOVID-19 outbreak (97.7% versus 88.2%) and, in contrast, penetrating trauma within the CXOVID-19 outbreak (2.3% versus 11.8%) in only children aged 6 to 12 years with no difference in other age subgroups (P = 0.036). Also, no difference was found in the type of trauma between the two periods considering gender and body mass index.

Multivariate regression analysis

In a similar multivariate regression analysis, there was no overall association between the period of assessment (pre-COVID-19 and COVID-19) and type of trauma (**Table 3**). Concerning the site of trauma, in children under two years of age, head and neck trauma was more reported before the COVID-19 period than in the COVID-19 period (55.6% versus 35.5%), while at this age, limb trauma was more common during the COVID-19 period than before (5.6% versus 20.8%) (P = 0.043). No difference was found between the two periods in trauma locations adjusted for other age subgroups as well as patients' gender. Also, in lean children, multiple traumas were more common in the pre-COVID-19 period than in the COVID-19 period (39.5% versus 0.0%). Still, in these children, abdominal and pelvic trauma were mainly seen in the COVID-19 period (28.6% versus 2.6%) (P = 0.035).

Multivariable logistic regression

The multivariable logistic regression analysis with the presence of gender, age, and body mass index parameters as the confounders (**Table 3**) showed a significant association between the location of trauma and the period of assessment, as a higher rate of head and neck trauma in the pre-COVID-19 period while a higher rate of limb trauma in COVID-19 period.

Discussion

As the first finding, the prevalence rate of traumatic injuries during childhood was specified to pre-COVID-19 periods and thus significantly reduced rate of such injuries can be found within the COVID-19 pandemic. The main reason for such a decline can be summarized in several ways. First, the reason for the decrease in the number of referrals can be considered in the application of social quarantines and avoidance of gatherings, and therefore the non-use of urban and intercity vehicles. As a result, we have also seen a decrease in road accidents.

Of course, this issue is not only for children but due to the harmful physiological system of the body of children, its adverse consequences are far more significant. Another reason for the reduction in the rate of brain trauma, especially in the case of trauma and mild and asymptomatic injuries, can be considered the fear of families going to medical centers and emergencies [14, 17, 18]. The fear of getting COVID-19 and attending medical centers, especially overcrowded ones, leads to families trying to manage and control related injuries on an outpatient basis. This decrease in the rate of referrals due to traumatic injuries is well evident in recent reports. In a study by Dibello and colleagues on Spanish children suffering traumatic injuries, a significant decrease in the rate of such injuries was reported within 2020 as compared to 2019 [19].

A report released by Soo and colleagues in 2021 showed that while the proportion of injuries sustained by pre-schoolers and toddlers increased, those suffered by primary and secondary school children decreased in 2020 as compared to 2019 [20]. According to earlier judgment, they similarly showed that most injuries during the lockdown were sustained at home compared to schools or public recreational facilities. As we indicated, extremities were more affected by traumatic events during the COVID-19 pandemic. Their study found that hand and elbow injuries were the most common during the COVID-19 lockdown.

Gokhale and colleagues also found that the age of children with significant traumatic injuries during the lockdown dropped significantly to 6.52 years as compared to before, similar to the peak age released by the current study as 2 to 6 years. Also, as expected, the incidence of outdoor injuries plummeted significantly from 64.71% in the baseline period to 41.27% during the lockdown period [21]. In another report by Chaudhari and colleagues, comparable to our observation, motor vehicle collisions increased during the pandemic probably due to the stressful behaviors caused by the thought of getting COVID-19 during this period [22, 23].

As an important finding, penetrating trauma was revealed more within the lockdown period especially among children aged 6 to 12. This event has two types of justifications. First, children at such ages may spend more time outdoors than children at younger ages and are therefore more prone to traumatic events, especially injuries resulting from accidents. Secondly, as special attention has been paid to it, the traumatic injuries of child abuse have also increased significantly during this period, which in many cases may lead to intrusive injuries.

Main limitations of this survey were the restricted study population and collecting of the data from a single trauma center in our region. Multicentric studies in various nations could reveal further data. It is also recommended that more attention should be given to providing practical guidelines to prevent injuries in the pediatric population.

Conclusion

Overall, what can be seen in this report is that although we see a significant reduction in referrals of children due to traumatic injuries to medical centers during the COVID-19 period, the severity of the injuries or their associated consequences is not in parallel with reducing the rate of referrals and therefore sensitivity to the proper management of these injuries and providing effective guidelines to prevent these injuries is essential.

Disclosure of conflict of interest

None.

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