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Epidemiological pattern of pediatric trauma in COVID-19 outbreak: Data from a tertiary trauma center in Iran

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ABSTRACT

Introduction: In Iran, like most other countries, COVID-19 has had a deep impact on children's lives. Our hypothesis was that, a significant change in the number of pediatric injuries has happened in trauma centers. In the current study, we intend to identify the possible epidemiological shift in pediatric fracture patterns, by comparing the data from 'COVID-19 era' and the mean data from the past 2 years. To the best of our knowledge there are only few reports on epidemiology of pediatric fractures during the COVID-19 outbreak.

Methods: Data are reported in two sections. In the descriptive section, epidemiological data regarding pediatric fractures referred to Taleghani tertiary trauma center, including demographics, distribution curves, etiologies and fracture types are presented during the 'COVID era', from 1 March 2020 to 15 April 2020. In the comparative section, the aforementioned data are compared with mean data from the past 2 years, the 'non-COVID era'.

Results: Altogether 117 of the 288 trauma children (40.62%) had a fractured bone (145 fractures). Patients were mostly boys, with a mean age of 9.87 years (SD=5.27). The three most common fracture types in children included distal radius, mid-forearm and humeral supracondylar fractures. Compared to non-COVID era, the number of pediatric trauma admissions dropped from 589 to 288. No significant change happened in the mean age, male/female ratio and percentage of motor vehicle accidents. Proportion of proximal humeral, proximal forearm, carpal, and hand fractures declined. The number of open fractures significantly dropped (from 12 to 2).

Conclusions: In Iran, overall trend of pediatric trauma has been decreasing during the outbreak; but the lack of reduction in proportion of accidents may pose an alarm that an effective lock-down has not been imposed. This study has implications as to preparing appropriate resources particular to common "COVID era fractures".

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Introduction

Since the declaration of corona virus disease 2019 (COVID-19) pandemic in 12 March 2020 [1], and even earlier, people and health care workers all around the world have been gathered together in a common war against the severe acute respiratory syndrome caused by corona virus 2 (SARS-COV-2). Probably as Bill Gates wisely said, viral infections are the real threat to human lives in the 21st century [2]. Early reports of COVID-19 spread in China, focused on the adult population with no reports of COVID-19 in children [3], but as the infection became a pandemic and spread throughout the world, more and more reports of infected children were published [4,5]. Now we know that children are not completely safe. That being said, for unknown reasons children are less susceptible to this infection than the adult population [5]. There have been some studies focusing on trauma in COVID-19 era [6–27]. Nonetheless, data on possible changes in hospital admission and injury characteristics of traumatized children in lacking. These data could prove beneficial in preparing resources.

In Iran, COVID-19 has had a deep impact on children's lives [28]. COVID-19 in Iran, coincided with "Nowruz" which is the beginning of the Iranian new year. The significant rise in travels that happens every year on Nowruz, couldn't be effectively stopped and this helped faster spread of the outbreak in Iran [29]. On the other hand, every year, schools throughout the country are closed during the 2-week period of Nowruz holidays. This year, COVID-19 caused the Iranian schools to stay closed after Nowruz, for the first time in the 21st century. Due to social distancing and personal precautions mostly taken by people themselves, children mostly have had to stay at home and like in many other countries, keeping the kids entertained and mentally healthy, has become a real challenge for many families [30]. COVID-19 outbreak has caused a significant change in the number of injuries we encounter in trauma hospitals. In the current study, we intend to discuss this epidemiological shift in fracture patterns in children, by presenting the data from COVID-19 era and last year and compare them. To the best of our knowledge there are only few reports on epidemiology of pediatric fractures during the COVID-19 outbreak.

Methods

This study has a descriptive and a comparative part. The descriptive part, is a retrospective analysis on patients referred to Taleghani Hospital, from March 1, 2020 (when social distancing precautions were imposed nationwide) until April 15 2020, the 'COVID era'.

The Committee on Ethics in Human Research at Kermanshah university has approved this study. Taleghani Hospital is a tertiary trauma center in western Iran, serving a minimum population of 2 million people in Kermanshah province plus neighboring provinces, and accepts a total 1500 to 3000 trauma patients per month (based on the data from Kermanshah local registry of fractures). Usually based on available records, 20–25% of patients admitted to the Orthopaedic emergency room are under 18 years old. Data regarding different fracture types in the referred trauma children, as well as mechanisms of injury, demographics, and distribution curves are presented.

In the second part of the study, the comparative part, mean data of 2018 and 2019 from the same center, and the same period of time are presented, which we will call it the 'non-COVID era'. This data will then be compared with the same data during the 'COVID era'.

Data are presented as means and standard deviations (SD) and percentages. Comparing data from each time period is conducted by using the Analysis of Variance (ANOVA) and Chi-squared tests.

Table 1
Statistics and Demographic data from the COVID and non-COVID era (NA: Not Applicable).

	Non-COVID (%)	COVID (%)	P-value
Mean age	9.87 (5.33)	9.98 (5.50)	0.119
Male-Female ratio	2.39	2.64	0.273
Trauma Admissions	589	288	NA
Patients with fractures	247	117	NA
Total fractures	295	145	NA

Table 2
Percentage of different mechanisms of injury in trauma patients during the non-COVID and COVID era.

Mechanism of injury	Non-COVID	COVID	P-value
Falling	58.9	49.3	0.008
Motor Vehicle Accident	9.6	8.3	0.51
Direct blow	13.5	14.9	0.55
Penetrating injury	16.1	25.7	<0.001
Other	1.9	1.7	0.88

Calculating P-values for compared percentages was performed with OpenEpi software [31]. All analyses are conducted using SPSS software version 25.0 (IBM corporation). P value < 0.05 is considered significant.

Results

Descriptive section

Altogether 288 trauma patients under 18 years old referred to our center during the study time frame, of whom 117 patients (40.62%) had a fractured bone with total of 145 fractures. Demographic characteristics are depicted in Table 1. Patients were mostly boys (M/F ratio: 2.64), with a mean age of 9.87 years (SD=5.27). The three most common fracture types in children included distal radius, mid-forearm and distal humeral supracondylar fractures in order of prevalence. During COVID-19 outbreak, 2 open fractures and 7 dislocations (3 in the lower limb and 4 in the upper limb) were encountered, in our emergency rooms. Frequency diagrams were used to demonstrate age-wise distribution of cases among boys and girls (Fig. 1).

Comparative section

Compared to the similar 45-day time period in the non-COVID era, the number of trauma patients has declined from 589 to 288. A similar 52% decline was seen in the number of pediatric fractures. A decrease in the mean age of children with fracture was seen, although it was not statistically significant (from 9.87 to 9.98). Male to female showed a non-significant increase from 2.39 to 2.64 ($P = 0.273$). The total number of fractures in boys and girls have decreased alike. Despite the general decline in the number of children referring with a fracture, relative percentages of different mechanisms of injury show no significant changes ($P = 0.116$) (Table 2).

Regarding different fracture types (Fig. 2), fractures of humeral supracondylar region, radioulnar shaft, distal forearm and proximal tibia showed a significant increase. On the other hand, proportion of proximal humeral, proximal forearm, carpal, and hand fractures declined. Howbeit, the three most common fracture types in children remained the same: Distal radius, mid-forearm and distal humeral fractures in order of prevalence. The number of open fractures significantly dropped from 12 open fractures in 2019 to 2 open fractures during the pandemic. In the non-COVID era, 3

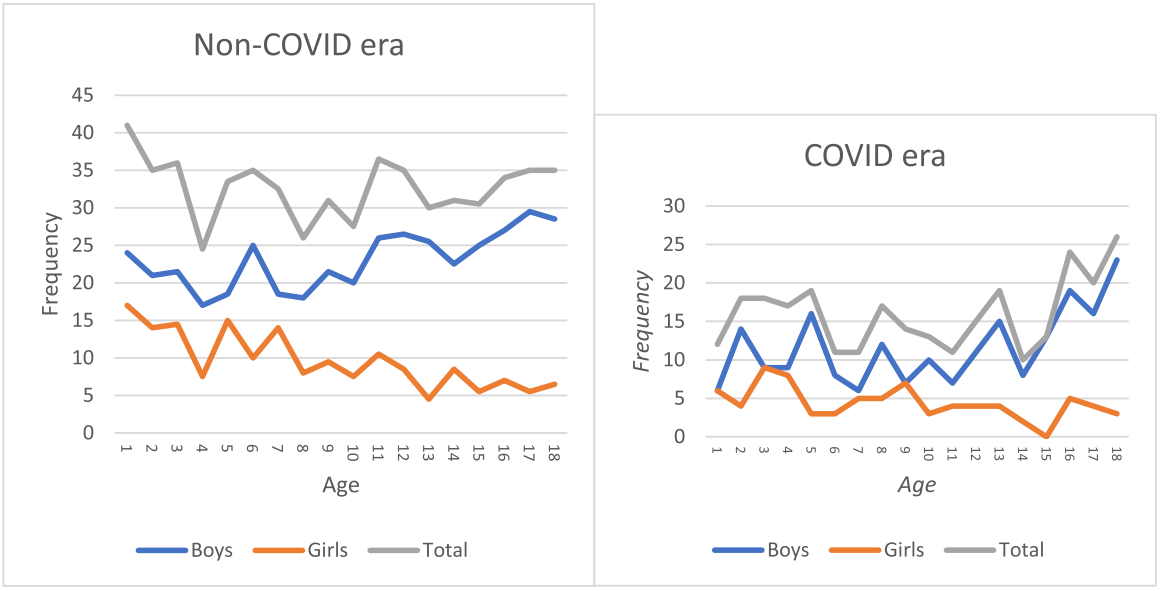

Fig. 1. Distribution curves in the non-COVID (left) and COVID (right) era. In each diagram, the horizontal axis shows patients' age, while the vertical axis shows frequency in boys (blue curve) and girls (orange curve) and in total (Grey curve).

dislocations (2 elbow and 1 finger dislocations) referred to our center which in turn increased during quarantine to 7 dislocations (3 in the lower limb and 4 in the upper limb).

Discussion

The current study shows a reduction in the number of injured children referred to orthopedic emergency during COVID-19 outbreak. This was expected, owing to social distancing and home quarantine, which has caused a change in people's behavior and lifestyles. Schools, kindergartens and sports activities were closed in Iran since March 1, 2020 and we witnessed a significant reduction in city traffics. These factors, along with the parents' fear of infecting their children by going to hospitals [32], have caused about 50 percent reduction in fracture patients referring to our emergency rooms. Similar even more significant trend has been recorded in other countries (50–70%) [33,34].

The proportion of trauma patients who were found to have a fractured bone didn't change during the outbreak. The overall number of trauma patients has decreased, but in contrast to similar studies on adults [33], in our study we saw no significant change in the fracture demographics. This could be due to the fact that previously children were not majorly affected by non-lock down activities. The mean age and male to female ratio have remained unchanged.

Comparing the distribution curves of the 'COVID era' with the past two years (Fig. 1), the general pattern is similar, but the difference between number of fractures in boys and girls has declined dramatically in the 'COVID era'. This might be in part due to the floor effect: The overall number of cases in both sexes has dropped, but frequency in girls in some age groups is so low that can't decline further as much as the boys. Moreover, compared with girls, boys were probably more involved with lock-down activities in the 'non-COVID era' [22,35], thus the impact of lock-down was more significant in boys.

Regarding mechanism of injury, Iran is one of the countries with a high rate of trauma due to motor vehicle accidents [36]. Surprisingly, no statistically significant change happened in the percentage of motor vehicle accidents during COVID-19 outbreak (P-value = 0.51). However, we expected to see lower traffic injuries during lock down. This could pose an alarm, that most probably lock-down measures were not effective enough. On the other hand, percentage of simple falls decreased significantly concurrent to a rise in penetrating injuries. In fact, it has been our common experience that fractures due to simple falls (mostly distal radius and mid-forearm fractures) in children usually rise in school season. It seems that closing of schools as well as stopping sports activities during the 'COVID era' has caused fewer simple falls to happen. Furthermore, more penetrating injuries were witnessed as a result of children playing with sharp objects at home. This shows the need for educating parents and paying more attention to children's safety at home. A report from the UK stated that despite the declining risks outside the house, because of possible problems inside the houses, the collisions of people at home caused injury. [34]. Christey et al. also reported increased trauma at home and farm and less accidents along with general decline in trauma patients [33].

In the case of fracture locations, distal radial, mid-forearm and supracondylar humerus fractures were the most common, both before and during the COVID-19 pandemic. In the case of supracondylar humerus fractures, a significant rise in percentage is seen, which can be due to the fact that it mostly occurs in the setting of low energy falls [22].

In this study, changes in the age and sex distribution of various types of fractures couldn't be presented due to the small number of cases. Multi-center studies could shed more light on the prevalence of fractures and different fracture patterns in children throughout COVID-19 pandemic according to age and sex, which are crucial information, helpful in preparing adequate resources for this susceptible population.

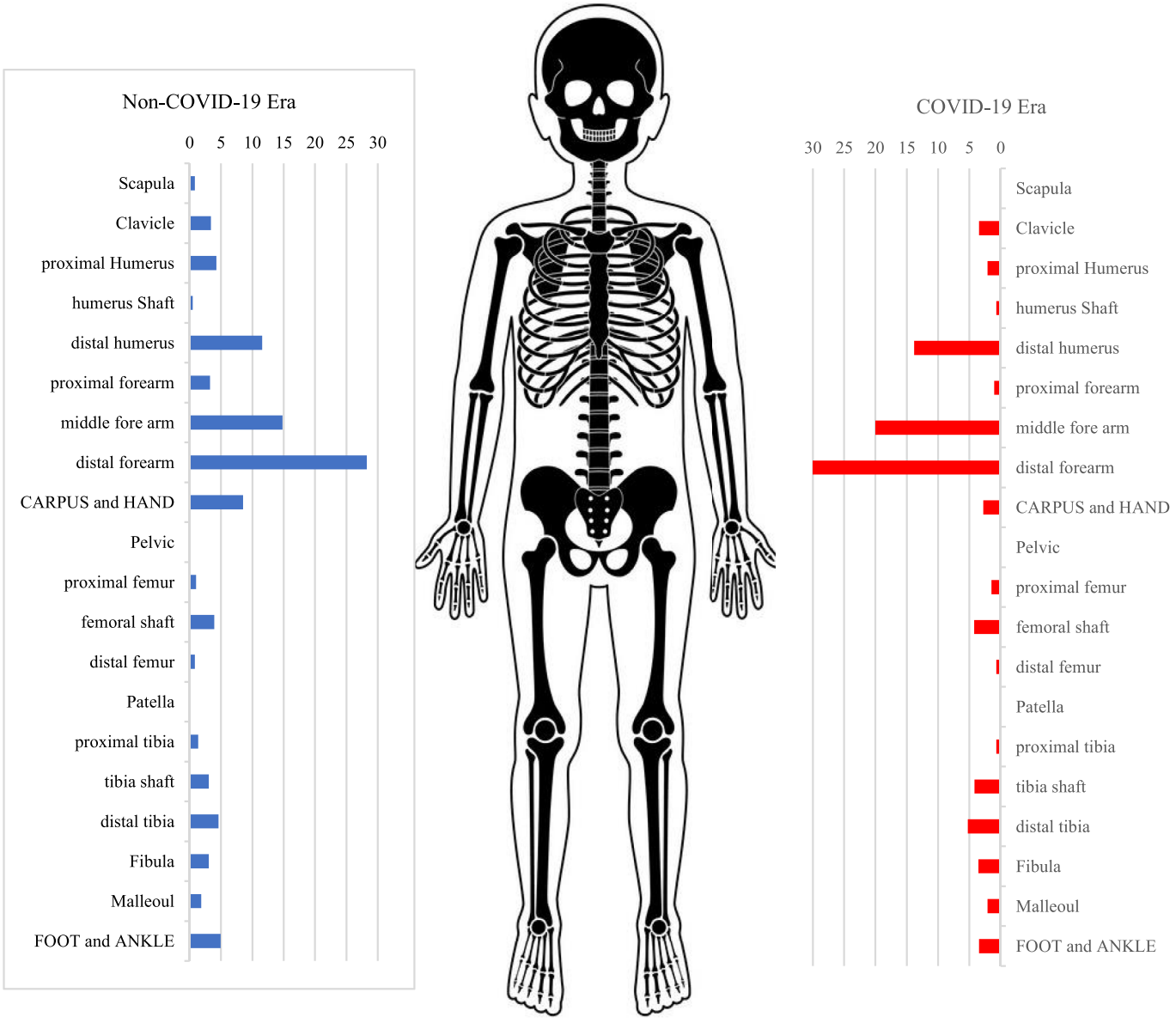

Fig. 2. Frequency charts for different fracture types during the non-COVID (left) and COVID (right) era.

Conclusions

Overall trend of pediatric trauma has been decreasing during the outbreak; but the lack of reduction in proportion of accidents may pose an alarm that an effective lock-down has not been imposed. This study has implications as to taking appropriate measures and preparing resources particular to common “COVID era traumatology”. Moreover, this study shows the need for attention to children safety and taking precautions at homes and playgrounds to prevent them from being injured.

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Declaration of Competing Interest

None.

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