Pediatric Emergency Response in a Non-Epicenter Hospital during the 2023 Turkey-Syria Earthquake: A Retrospective Study of 125 Cases in the First 20 Days

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Background: The 2023 Turkey-Syria earthquakes affected a large population. Ankara Mamak State Hospital, a non-epicenter hospital, was also making efforts to treat earthquake patients. This retrospective study was conducted from this non-epicenter hospital during the 2023 Turkey-Syria earthquake and aimed to evaluate the emergency response to 125 pediatric patients identified in the first 20 days.

Material/Methods: The cases were scanned from the hospital’s electronic registry system by age and diagnosis code. We recorded the demographic data of patients under the age of 18 years, the day they arrived, the provinces they left, their diagnoses, treatments, consultations, characteristics of trauma in traumatic cases, and outcomes of all children in a non-epicenter hospital. We detected 125 pediatric cases in the first 20 days.

Results: There were 125 pediatric patients under the age of 18 who arrived to the Emergency Department (ED). On the 6th day, the number of cases peaked. Their mean age was 7.9±5.6 years (minimum: 0, maximum: 18) and 52.8% were males. Most cases had non-traumatic internal disease (81.6%) and were most (97.6%) were discharged from the ED. While soft-tissue injury was the most common diagnosis in traumatic cases (69.9%), there were more (56.5%) extremity injuries according to the affected body zone.

Conclusions: After major disasters, there may be an increased number of pediatric patients taken to hospitals far from the disaster area. For this reason, non-epicenter hospitals should be prepared to provide an adequate number of health care workers and sufficient supplies and equipment.

Keywords: Disaster Medicine • Disaster Victims • Earthquakes • Emergency Medicine • Pediatric Emergency Medicine

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Background

Earthquakes not only cause severe injuries in a short time, but also cause migration movements in survivors [1]. Turkey is a country established on active earthquake faults [2]. On 6th February 2023, 2 consecutive earthquakes with magnitudes of 7.8 and 7.5 Mw (moment magnitude) sourced from 2 different epicenters (37.05°E 37.23°N and 37.23°E 38.11°N) shook south and southeast regions of Turkey [3]. These 2 major earthquakes were followed by 200 aftershocks. Many areas affected by the earthquake were located between the North Anatolian Fault and the East Anatolian Fault [4]. In Turkey, 11 provinces and 9.1 million people were affected, with 44 000 deaths and 108 000 injuries [5], and 2.2 million people were displaced from disaster zones to safer provinces [5]. Immediately after the earthquakes, temporary disruptions occurred in health services. Healthcare workers worked selflessly with long and tiring shifts [6]. In the emergency services located in the disaster area and not damaged, an unusually large crowd of people formed [7]. Patients affected by the earthquake were also examined in non-epicenter hospitals in the following days [8]. Temporary hospitals were built very quickly and 74 000 health workers struggled to practice disaster medicine [9]. The health organization in Turkey successfully and safely transported many patients out of the disaster area by highways, airlines, and maritime lines [9]. The risk of orphaned children is even higher when surviving earthquake patients are considered [10]. These children, who are deprived of parental and family supervision, can be abused in various crimes, sexually assaulted, or used as slaves [10]. Developing countries have a high proportion of the population composed of children, who account for a large share of the patients hospitalized in such earthquakes [11,12]. School-age children are the most affected age group. In the acute period, the need for orthopedic and general surgery is high for these children. In the following days, infectious problems appear more in children than in adults [12]. Therefore, health care for surviving children is very important [10]. This retrospective study was conducted from a non-epicenter hospital during the 2023 Turkey-Syria earthquake and aimed to evaluate the emergency response to 125 pediatric casualties identified in the first 20 days.

Material and Methods

Study Design and Ethics

This study was approved by the local clinical research ethics committee (approval no. 2023/283). After this approval was obtained, earthquake patients under the age of 18 years were scanned into the database of Mamak State Hospital retrospectively. This hospital is a district hospital with 200 beds and has an emergency department that is open all days of the year and around the clock. The 2 major earthquake epicenters were 646 and 619 kilometers from the hospital.

Data Collection

Pediatric cases who applied to the emergency department within 20 days starting from 6th February 2023, when the earthquakes occurred, and ending with 25th February 2023, were included. Pediatric patients’ age, gender, days presented after earthquakes, provinces they came from, hemodynamic parameters, triage zones according to Manchester Triage System flowchart, body zones injured, injury types, diagnoses in Emergency Department (ED), result of ED visit, duration of hours in the ED, and consultations were recorded. Exclusion criteria were patients older than 18 years and those with missing data.

Statistical Analyses

Statistical analyses on the recorded data were made using SPSS 24.0 (SPSS; IBM Corp, Armonk, NY, USA). Mean±standard deviation (minimum(min)-maximum(max)), median values (and quartiles), percentages, and frequency distributions were used to present descriptive data.

Results

There were 125 pediatric patients admitted to the ED in the first 20 days after the earthquakes. The highest number of cases – 30 – presented on February 11th (the 6th day after the events). On February 6th, the day of the disaster, no cases came to the ED (Figure 1) and there were no cases transferred from another hospital in or outside the disaster area. All patients were cases that came to our hospital by their own vehicles using the highways in Turkey.

Demographic Characteristics of Patients

The mean age of pediatric patients was 7.9±5.6 years (min: 0, max: 18); the median age was 7 (Q1: 3-Q3: 12.5); 66 (52.8%) were male and 59 (47.2%) were female. Patients arrived to our ED from 7 different provinces in the disaster area. These provinces are very far from Ankara. The average distance between the centers of these 6 provinces and our ED is 684 km (min: 500, max: 827). Among them, according to the number of cases, Kahramanmaraş and Hatay had higher percentages, with 28.0% (n=35; Figure 2) and 27.2% (n=34; Figure 2), respectively.

Clinical Results

Hemodynamic parameters of all cases were stable. Using the Manchester Triage System flowchart in the ED, a very high
Figure 1. Number of pediatric aged patients who presented to the Emergency Department of the non-epicenter Ankara Mamak State Hospital by date in first 20 days after the February 2023 Turkey-Syria Earthquakes (no patients presented on 6 February 2023).

Figure 2. Number of pediatric patients, according to the provinces they came from, in the first 20 days after the February 2023 Turkey-Syria earthquakes to Emergency Department of Ankara Mamak State Hospital and epicenters of earthquakes (×) (This figure is powered by Bing, and produced using Microsoft Office Word and TomTom).
percentage (80%) of them had a green zone triage code, the remaining 20% had a yellow triage code, and there were no cases with a red triage code. There were 102 cases (81.6%) with internal disease, 23 cases had trauma, and 19 of them (15.2% of all 125 patients) were earthquake related. One hundred twenty-two (97.6%) of 125 cases were discharged with recovery from the ED. None of them died in the ED. The mean duration of stay in the ED was 1.7±1.2 h (min: 1, max: 6), and the median stay was 1 h (Q1: 1-Q3: 2). A total of 21 consultations were done among 125 cases, 18 of which were with pediatricians and 3 with orthopedists (Table 1).

When the clinical findings of cases admitted with trauma-related injuries were examined, there were 17 penetrating injuries and 3 blunt injuries. The lower extremities were the most affected body zone, with 10 cases, followed by 8 cases of head trauma. There were 16 soft-tissue injuries. There were 15 wound dressings performed in the emergency room, and this was the most common surgical treatment (Table 2).

There were more non-traumatic diagnoses (n=102) than traumatic diagnoses. There were 53 cases (52.0%) with upper-extremity infections. Many treatments in this group involved drug prescription (n=100; Table 1).

Discussion

This study assessed 125 pediatric earthquake patients admitted with a traumatic or non-traumatic disease to a non-epicenter hospital in first 20 days following the massive 6th February 2023 Turkey-Syria earthquakes. Males were slightly predominant, most of them were green triage coded and stable, most did not have trauma, and most were discharged with a drug prescription. The predominance of the green triage code may because the most serious cases were treated within the disaster area or transferred by health professionals by ambulances. We know that all of the cases in the study applied to the hospital where the study was carried out with their own vehicles without professional health care during their travels to Ankara. It would be medically very difficult for serious cases to reach the hospital.
be done effectively by highways, by air, and by boat [7]. This patient transfer to the near and then distant provinces could first days after these earthquakes, but in the following days, reported that the patient transfer power was weakened in the report about the 6\textsuperscript{th} severity cases. Yılmaz et al, in their recently published field report is also compatible with the application times of the patients included in our study. Cases included in the study applied less in the first days of the disaster and peaked on the 6\textsuperscript{th} day. In the first days of the disaster, damage to highways may have hindered transportation to areas far from the disaster area. Accordingly, hospitals far from the disaster area may be relatively busy in the following days rather than during the first days. Yılmaz et al, in the same report, explained that there were many patient transfers from nearby provinces to Adana in the acute period [7]. When we look at the provinces where the patients came from in our study, it is seen that more cases came from Kahramanmaras and Hatay. Adana was far behind these 2 provinces, with only 5 cases (Figure 2). Accordingly, it can be concluded that the health services in the provinces relatively far from the epicenter of the earthquake were less disrupted than in the regions near the epicenter. Of course, more comprehensive studies with different methodologies may provide different results. Gürü et al also drew attention to the stability of the cases in their study, where they reported adult patients in the same earthquakes that were also in the same hospital. The stability of the cases was also concluded in the study in which the adult cases in the same hospital were examined [8]. In this study, it was similarly concluded that relatively more stable cases were treated in non-epicenter hospitals with pediatric earthquake patients. Cases transferred by ambulances because they were not in the study were excluded. Different conclusions may be reached by future studies in which such transferred patients are included.

As the hospital where the cases of this study were located is a non-epicenter hospital, the fact that it is a non-epicenter hospital. Presumably, the patients applied to hospitals in the disaster area in the first days, and relatively stable cases migrated to non-epicenter hospitals such as the hospital where the cases of this study were located. In the study of Gürü et al, presenting adult cases from the same hospital, reporting adult patients in the same earthquakes where they reported adult cases in the same hospital. The stability of the cases was also concluded in the study, where they reported adult cases in the same hospital. Gürü et al also drew attention to the comprehensive studies with different methodologies may provide different results. Gürü et al also drew attention to the stability of the cases in their study, where they reported adult patients in the same earthquakes that were also in the same hospital. The stability of the cases was also concluded in the study in which the adult cases in the same hospital were examined [8]. In this study, it was similarly concluded that relatively more stable cases were treated in non-epicenter hospitals with pediatric earthquake patients. Cases transferred by ambulances because they were not in the study were excluded. Different conclusions may be reached by future studies in which such transferred patients are included.

In this study, it was determined that the most cases were admitted on 11 February 2023, which was 6 days after the earthquakes, and there were no applications on the first day. The absence of admissions on the first day can be explained by the fact that it is a non-epicenter hospital. Presumably, the patients applied to hospitals in the disaster area in the first days, and relatively stable cases migrated to non-epicenter hospitals such as the hospital where the cases of this study were located. In the study of Gürü et al, presenting adult cases from the same earthquakes, it is seen that the peak event time was 9\textsuperscript{th} February 2023 [8]. The data of this study are similar in terms of both the peak time and the decrease of cases towards the end of 20 days. It can be concluded that relatively stable cases apply to hospitals after the first few days of disasters. In a small pediatric group, Sanadgol et al examined earthquake patients who came to a hospital in the disaster area and reported that 75\% of the children applied on the first day [13]. Similarly, Çağran et al examined cases in a hospital in the disaster area during the 2020 Aegean Sea earthquake and pointed to the first 12 h was the peak time for admissions [1]. That study shows there are many admissions in the first hours after the disaster to hospitals located in the disaster area and that can continue to work operate, and that there are more admissions at non-epicenter hospitals, like this study, after the first days have passed.

Table 2. Injury type, body zone injured, traumatic diagnoses, surgical treatments of pediatric aged patients admitted to non-epicenter Ankara Mamak State Hospital with trauma-related injuries, in first 20 days following the February 2023 Turkey-Syria earthquakes.

<table>
<thead>
<tr>
<th>Injury type (n=23) (%)</th>
<th>Penetrating</th>
<th>Blunt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17 (73.9)</td>
<td>6 (26.1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Body zone injured (n=23) (%)*</th>
<th>Lower extremity</th>
<th>Head</th>
<th>Upper extremity</th>
<th>Spinal vertebra</th>
<th>Thorax</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 (43.5)</td>
<td>8 (34.8)</td>
<td>3 (13.0)</td>
<td>2 (8.7)</td>
<td>2 (8.7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Traumatic diagnoses in ED (n=23) (%)</th>
<th>Soft tissue injuries</th>
<th>Skin incision</th>
<th>Bone fracture</th>
<th>Infrathoracic organ damage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16 (69.6)</td>
<td>5 (21.7)</td>
<td>1 (4.3)</td>
<td>1 (4.3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Surgical treatments (n=23) (%)</th>
<th>Wound dressing</th>
<th>Primary suture</th>
<th>Plaster splint</th>
<th>Corset</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15 (65.3)</td>
<td>5 (21.7)</td>
<td>2 (8.7)</td>
<td>1 (4.3)</td>
</tr>
</tbody>
</table>

\(n\) – number of patients; ED – Emergency Department; Continuous variables were presented as "mean±SD (minimum-maximum)" and categorical variables as "number (percentage of column)".* There is more than one in a patient, percentage calculated on the number of patients.

disaster area by their own vehicles. In this and other disasters, such serious cases may have been treated in hospitals in the disaster area. Stable patients may have gone to hospitals in distant provinces on their own. Of course, treatment of these less severe cases in the disaster area may be more rational, but we think that the patients who came to our hospital migrated due to housing and living problems other than health problems and then applied to the hospital in Ankara. On the other hand, the large number of serious injuries in the disaster area may not provide sufficient opportunities for the treatment of such low-severity cases. Yılmaz et al, in their recently published field report about the 6\textsuperscript{th} February 2023 Turkey-Syria earthquakes, reported that the patient transfer power was weakened in the first days after these earthquakes, but in the following days, patient transfer to the near and then distant provinces could be done effectively by highways, by air, and by boat [7]. This
We found that more cases came from Kahramanmaraş and Hatay compared to other provinces. Yilmaz et al reported that the 2023 Turkey-Syria earthquakes caused more physical damage in Kahramanmaraş, Hatay, and Adıyaman [7], and these areas with greater physical damage had more injured people. Although most of our cases were non-traumatic, the fact that these cases came to a non-epicenter hospital may also be the result of human migration. All these data lead to the conclusion that the earthquake had a more intense effect in these provinces.

Considering our results, it was reported that most pediatric earthquake patients came to hospitals for non-traumatic problems. Upper respiratory tract infections were the most common diagnosis in this group and most of these children were discharged with a drug prescription. This explains the excess of green triage coded patients in the study. The most prominent diagnosis of traumatic cases was soft-tissue injuries. Iskit et al reported soft-tissue injuries as the leading diagnosis in their study reporting on earthquake injuries in 33 children [14]. Gürüş et al reported soft-tissue injuries in adult patients in the same hospital as a leading traumatic diagnosis [8]. This has been reported several times and, in this study, the most common traumatic diagnosis in adults and children after the earthquakes was soft-tissue injury. Accordingly, improvements that facilitate the treatment of this diagnosis can improve health care immediately after earthquakes. Considering that the injuries to the extremities are more common, the presence of orthopedic specialists in hospitals far from the disaster area may be beneficial in the first days after an earthquake. Of course, we think that pediatricians can also provide critical support for internal diseases seen in this study.

In this study, extremity injuries were the major body zone injured in children with a diagnosis of trauma. This result is very consistent with the literature. In many studies, both adults and children had extremity injuries reported as the body zone most affected in earthquakes [8,12,15]. Fu et al reported extremity injuries as precursor injuries in children who were affected by earthquakes, regardless of factors such as age and gender. Accordingly, they drew attention to crush injuries and the criticality of fluid replacement therapy [15]. Zhao et al also drew attention to the excess of extremity injuries in their study, where they reported pediatric injuries after the earthquake [12]. Baron et al reported that extremity injuries were the most affected body zone in children after the 2010 Haiti earthquake [11]. In our cases, the injuries were often minor, so few orthopedics consultations were needed. This can of course be explained by the fact that we are a non-epicenter hospital. More severe cases after these earthquakes were transported by highways, air, and boats, as stated in the field report of Yilmaz et al and the minister’s statement [7,9]. When evaluated together with the data of this study, it can be predicted that less severe cases come to non-epicenter hospitals.

This study has some limitations. First, it was a retrospective, single-center study with only 125 patients, there were no mortalities, and there was no data on the care and treatment patients received before admission. Although the fact that it was performed in a non-epicenter hospital gives a different perspective, data on the disaster area could not be presented in this study. In the future, better quality results can be obtained with more comprehensive and multicenter data.

Conclusions

Pediatric patients who were affected by earthquakes increase the workload in hospitals far from the disaster area. Accordingly, non-epicenter hospitals should take precautions in terms of the number of health care workers and equipment. While this increase in workload is minimal in the first days after the earthquake, it grows in the following days. After earthquakes, non-epicenter hospitals encounter relatively few severe cases. The extremities are the most frequently affected body zone in children with trauma in non-epicenter hospitals, as well as in epicenter hospitals.

Department and Institution Where Work Was Done

Department of Emergency Medicine, Mamak State Hospital, Ankara, Turkey.

Declaration of Figures’ Authenticity

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