J Pediatr Res 2023;10(4):264-9
DOI: 10.4274/jpr.galenos.2023.40374

Original Article

Disaster Consequences: Wish Hadn't Happened

Şule Gökçe, Burçe Emine Dörtkardeşler, Beren Ayhan

Ege University Faculty of Medicine, Department of Pediatrics, Division of General Pediatrics, İzmir, Turkey

ABSTRACT

Aim: Natural disaster related injuries result in deaths and disabilities such as from a major earthquake. The object of this case series study was to determine the demographic characteristics, injuries, and clinical outcomes of victims admitted to a General Pediatrics Unit within the first weeks after an earthquake.

Materials and Methods: This was a retrospective case series study carried out on Kahramanmaraş earthquake victims in a tertiary medical faculty in İzmir from February 13th to March 29th, 2023.

Results: Of the followed up 9 earthquake survivors, their mean age was 3.8 years. All of the victims were transferred from other earthquake affected provinces to İzmir. In all, 9 of the cases were admitted to the emergency services of the disasters area hospital and 5 (55.5%) of the 9 cases were rescued from under rubble. For all age groups who were extracted from under the rubble, the extremities were most injured (44.5%). All survivors trapped under the rubble needed fluid therapy, renal support treatment (hemodialysis), and 2 cases required amputation.

Conclusion: The description of the demographic characteristics and clinical outcomes of earthquake victims is important in order to determine medical amelioration and rehabilitation services for future disasters.

Keywords: Earthquake, children, traumatic rhabdomyolysis

Introduction

On the 6th of February, 2023, known as one of the greatest disasters of the century, several series of massive earthquakes struck south-eastern Turkey including 11 provinces near the border with the Syrian Arab Republic. An earthquake of 7.7 magnitude struck and hundreds of aftershocks caused significant destruction at 04:17 local time with its epicenter located in the Pazarcık district in Kahramanmaraş province (Figure 1). Roughly 15 million people who lived in these areas and around 4.6 million children experienced the highest magnitude earthquake recorded and more than 13,000 aftershocks occurred, destroying hundreds of buildings, including schools. The earthquake devastated this area a week before the beginning of the second period of the school year, and consequently, all schools were closed for weeks in Turkey. Unfortunately, the victims suffered not only physical, but also significant psychological damage. With the addition of limb and organ losses to this situation, pain grew exponentially and it deeply affected the entire community.

According to Disaster and Emergency Management Presidency, more than 45,000 people were reported to have been killed across Turkey as of the 6th of March, more than 115,000 people were injured, and 9.1 million people were affected by the earthquakes (1). Although there is no certain data regarding children, exposure to earthquakes can cause serious health problems, especially in early childhood. The lack of personnel/death of staff during

Address for Correspondence
Şule Gökçe, Ege University Faculty of Medicine, Department of Pediatrics, Division of General Pediatrics, İzmir, Turkey
Phone: +90 232 390 12 69 E-mail: sule.gokce@ege.edu.tr ORCID: orcid.org/0000-0003-3392-4990
Received: 13.07.2023 **Accepted:** 05.11.2023

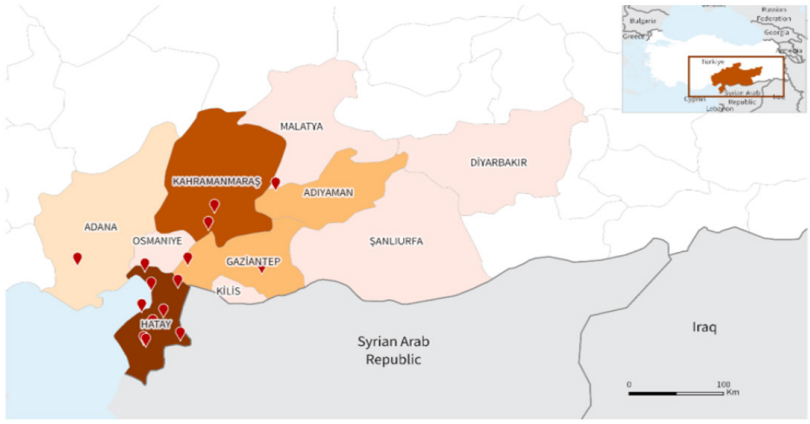

Figure 1. The provinces affected by the earthquake (World Health Organization)

earthquakes and damage to medical infrastructure may lead to an increase in the loss of life and injuries caused by earthquakes. Unfortunately, the injuries presenting needed intensive curative medical and surgical care putting strain on both the local and regional medical services for all territories (2,3). As part of this need, physicians from all over Turkey were sent to the affected regions. Patients from the affected regions were also referred to various clinics outside of the affected regions. The purpose of this case series study was to describe the characteristics of the victims' demographic features, injuries, and their clinical outcomes, for those cases who were referred from the earthquake zone to the Ege University Faculty of Medicine Children's Hospital General Pediatric Clinic within the first week after the earthquakes. To the best of our knowledge, this article is one of the first to investigate in depth the medical support and harm/loss profiles of pediatrics victims who were provided with medical and psychological support during the posttraumatic period in the Kahramanmaraş/Turkey earthquake. This case study could contribute to the recovery policies, and so help in improving and developing preparedness for future disasters such as earthquakes.

Materials and Methods

Participants and Data Collection

After the Kahramanmaraş earthquake, in the early hours of the disaster, a contingency plan was immediately launched involving a rescue operation by national and international medical institutions. A number of injured people and children were transferred to other hospitals such as Ege University, Childrens' Hospital in the first weeks after the earthquake due to the absence of medical equipment and support in the earthquake zone in the first days after the earthquake.

This study retrospectively investigated the clinical records of the admitted patients to the General Pediatric Ward from the earthquake area. The participants were evaluated as earthquake victims by using data between February and March, 2023 from Kahramanmaraş province and the southeastern Anatolia region of Turkey. The participants' parents and family members provided various information related to their demographic and social data. In addition, detailed information from other hospitals about the management of medical relief work was also obtained via interviews with medical professionals and medical rescue teams. The clinical records of 9 pediatric earthquake victims, who were admitted to our ward based on their medical records database, including demographic data, diagnoses, injury profiles, complaints, etc., were collected by a physician in the general pediatric unit. The diagnoses for patients with injuries or diseases were based on the final diagnosis such as the occurrence of any post-earthquake symptoms experienced by the participants, and systemic dysfunctions and anxieties according to the attending general pediatric unit physician. In the light of this diagnosis and the preliminary diagnoses, the patients were treated in the pediatric clinic, the pediatric sub-disciplines, and other departments for their critical follow-up, and a prosthesis process for amputee patients was started.

Ethical Considerations

This study adhered to the tenets of the Declaration of Helsinki and was approved by the Ege University Faculty of Medicine Clinical Research Ethics Committee (approval no: 23-6.1T/44, date: 06.07.2023).

Results

General Profile

The mean age of the hospitalized patients in the General Pediatrics Unit of Ege University Childrens' Hospital was 3.8 years. Of these, 6 (66.6%) were male. Due to this natural disaster situation with its transfer chain, the number of hospitalized patients reached a peak in the first week after the disaster. The admissions of the 9 patients is shown in the table which also shows their demographic data, reason for hospital admission, and injury diagnosis (Table I). During this period, only 9 patients were referred from the earthquake zone. Four of the patients presented with multiple injuries (44.4%), and the others with a single or no injury. Among the patients trapped under the rubble with multiple injuries, 3 patients with crush syndrome and rhabdomyolysis presented with acute renal injury and renal insufficiency. There were only four patients who

Table I. Demographic data, reason for hospital admission, and injury diagnosis of admitted patients with earthquake-related

	Patients				
	(Case 1) İ. M.	**(Case 2) S. Ö.**	**(Case 3) D. A.**	**(Case 4) H. Y. D.**	**(Case 5) A. T.**
Data					
Hospital stay interval	10/02/2023-21/02/2023	13/02/2023-05/03/2023	13/02/2023-24/02/2023	05/03/23-09/03/23	10/02/2023-11/02/2023
Date of birth	31/07/2016	07/10/2021	09/04/2006	27/04/2011	01/10/2021
Age	6 years	1 year 4 months	16 years	1 year 7 months	1 year 2 months
Gender	Male	Male	Female	Male	Male
Earthquake city	Adana	Hatay	Hatay	Kahramanmaraş	Kahramanmaraş
Pull from rubble time (hours)	Unknown	53 hours	Unknown	Unknown	2 hours
Length of hospital stay (day)	11	21 days	12 days	5 days	2
Reason for hospital Admission	Crush syndrome, acute renal injury, amputation	Crush syndrome and left ulnar artery injury?	Amputation of right knee left below knee, right thorax tube with pneumothorax, and liver contusion	Pneumonia	Victim observation
Physical examinatıon	Two-leg above-knee amputee	Left forearm with fasciotomy in splint	Amputation of right knee and left below knee	Tachypnea and bilateral rales on the lung	No major traumatic features
Surgical operation	Both legs were amputated above the knee (before admission)	Left forearm fasciotomy (before admission)	Amputation of right leg above knee, left below knee (before admission)	No	No
Final diagnosis	Past crush syndrome and amputation	Past crush syndrome and fasciotomy	Past pneumothorax, and amputations	Pneumonia, victim observation and discharge	Victim follow-up and discharge
	Patients				
	(Case 6) E. B.	**(Case 7) M. S.**	**(Case 8) M. M. G.**	**(Case 9) Y. G.**	
Data					
Hospital stay interval	10/02/2023-12/02/2023	12/02/2023-16/02/2023	11/02/23-16/02/2023	08/03/2023-13/03/2023	
Date of birth	01/03/2007	15/12/2022	14/07/2016	29/09/2017	
Age	1 year 7 months	2 months	6 years	5 months	
Gender	Female	Female	Male	Male	
Earthquake city	Hatay	Kahramanmaraş	Malatya	Hatay	
Pull from rubble time (hours)	10	Unknown	78	10	

Table I. Continued

	Patients			
	(Case 6) E. B.	**(Case 7) M. S.**	**(Case 8) M. M. G.**	**(Case 9) Y. G.**
Data				
Length of hospital Stay (day)	3	4	6	6
Reason for hospital Admission	Femur fracture, follow-up	Mild tachypnea	Rhabdomyolysis follow up	Pneumonia
Physical examinatıon	Hematoma, abrasion, ecchymosis on left leg with splint (visible parts)	Bilateral sibilant rhonchus and wheezing	5 cm incision in the forehead	Tachypnea and bilateral crepitant rales on the lungs
Surgical operation	No (Femur operation before admission)	No	Forehead area debridement and site repair	No
Final diagnosis	Left femur fracture	Bronchiolitis	Forehead area trauma, past rhabdomyolysis	Pneumonia, victim follow-up

were followed up for observations and clinical progress for respiratory problems such as pneumonia and bronchiolitis.

One of the most harrowing patients was an orphaned 6-year-old male patient who was trapped for unknown hours under the earthquake debris. Before transporting the child to our hospital, he was evaluated by physicians for general progress and injuries. His bilateral thigh was edematous and painful. Laboratory results revealed creatinine: 1.58 mg/dL, potassium: 6.11 mmol/L, serum pH: 7.35, bicarbonate: 16.8 mmol/L, lactic acid: 5.48 mmol/L and creatinine phosphokinase (CPK) of 25,700 U/L. Despite fluid and bicarbonate infusion, his renal function deteriorated, and his bilateral thighs became more tense resulting in a compulsory fasciotomy. He required 2 additional sessions of hemodialysis before complete resolution of the acute renal failure caused by traumatic rhabdomyolysis. By that time (24 h after hospital admission), the bilateral lower extremity was severely cold and cyanotic despite fasciotomy, so above-knee amputation was performed. He was transferred to our hospital's general pediatrics ward 5 days after admission to begin rehabilitation and administration of the general health follow-up with a stable cardiorespiratory state (SpO_2 of 98%, heart rate of 89 bpm, blood pressure of 96/62 mmHg and a respiratory rate of 18/min). On presentation, he was evaluated as having a Glasgow Coma Scale of 14 and showed a deeply depressed mood. Initially, the boy was evaluated by pediatric orthopedic surgeons for the first stage of damage control. Clinical examination revealed no pathological sign except two-leg above-knee amputation. Biochemical studies revealed aspartate amino transferase of 232 IU/L, alanine aminotransferase of 131 IU/L, and gamma-glutamyl transpeptidase of 10 IU/L, CPK: of 5,636 U/L, C-reactive protein of 1.6 mg/dL, creatinine of 0.4 mg/dL with normal urine output and urinary analysis. He was examined in the pediatric psychiatric department for trauma symptoms, which may be associated with long-term negative psychological changes in children experiencing disasters. General systemic disease screening and other necessary examinations were performed along with biochemical controls, as well as consultations for vaccinations and rehabilitation with social workers and the social pediatrics department. He was finally discharged 11 days later with a follow-up plan.

Discussion

Earthquakes are natural disasters characterized by strong terrestrial movements in a short period of time and they may cause destruction to health and the medical infrastructure. It was stated that 387 natural hazards and disasters occurred worldwide resulting in the loss of 30,704 lives affecting 185 million individuals in 2022 according to Emergency Event Database ''EM-DAT'', International Disaster Database. Earthquakes have injured more than 60 million people and approximately 400,000 have been killed during the last 30 years (4). Regrettably, our country is located in the Mediterranean-Alpine-Himalayan belt which produces at least one earthquake with a magnitude ranging from 5.0 to 6.0 every year. Turkey is one of the most earthquake prone countries in the world. In Turkey, on average, once every five years, a major earthquake occurs causing a loss of life and property damage on a large scale (5). On February 6th, 2023, two major earthquakes of magnitudes 7.7 and 7.6 with a 9-hour interval, and also a total of 11,020 aftershocks occurred on the Eastern

Anatolian Fault Line, violently shaking 11 provinces in the Eastern and Southeastern Anatolia regions. Pazarcık and Elbistan of Kahramanmaraş province were determined as being the worst affected districts of the earthquake (6).

The management of polytraumatized pediatric patients suffering from earthquakes needs to be handled via a multidisciplinary approach including pediatric and orthopedic surgeons with the aim of damage control. The first stage of treatment to prevent death is to control any bleeding, to reduce contamination, to implement renal replacement therapy, to provide a temporary fixation on extremities, to supply a fluid-electrolyte balance, and to consider any surgical requirements (i.e., debridement, fasciotomy, or amputation) (7,8). Several earthquake studies have mostly reported that fractures were a large share of injuries, followed by soft tissue injury, contusions and lacerations. In an adult study on the 2013 Lushan Earthquake in China conducted by Peng Kang et al. (9), fractures accounted for 41.5% of the injuries, soft tissue injuries accounted for 27.5%, and contusions and lacerations accounted for 25.0%. The lower extremities and pelvis have been determined to be the most frequently injured anatomic sites, followed by the body surface, head, and spine in other earthquake studies (10). In our study, the patients suffering from earthquake-related physical trauma showed higher incidences of orthopedic injuries, particularly extremity problems of the lower limbs and traumatic rhabdomyolysis resulting in amputations and renal injuries. The most often injured anatomic areas were the extremities, followed by the body surfaces, and head. After stabilizing life-threating conditions, the patients need to be evaluated with a systemic approach, with both physical and psychological support in order to improve their life conditions. Orphaned children should be consulted by a social worker and the social pediatrics department. Our patients were evaluated by multiple departments, pediatrics divisions, and other disciplines during their hospitalization.

Earthquake-related mortality and morbidities generally originate from multiple-traumas, multiple fractures, soft tissue injuries, and crush injuries caused mostly by building collapses for individuals with poor socioeconomic conditions, who live in poor quality structures. One of the most threatening events in major earthquakes is traumatic rhabdomyolysis, also known as crush syndrome, which leads to acute kidney injury and failure. The mechanism of this syndrome is characterized firstly by ischemia and the reperfusion of decompressed extremities. During compression and ischemia, an intracellular influx of calcium occurs due to low production of adenosine triphosphate causing muscles lysis (8). Traumatic rhabdomyolysis has been reported following several earthquakes from all over the world, including Turkey. In the Marmara earthquake in 1999, crush syndrome accounted for 33% among hospitalized patients (11). Another earthquake study reported 48.9% of survivors were trapped under rubble and were diagnosed with extremity crush injuries (12). In the present study, 3 patients (33.3%) were identified with crush syndrome and presented with renal injury.

Earthquake-related injuries are mostly influenced by the location and/or being awake or asleep. Due to the fact that the victims could not escape due to the building collapses, numerous people were trapped under the rubble in their homes during the earthquake at 04:17 local time. Due to the fact that children are vulnerable to trauma and their body mass is small, they are more likely to be affected by major traumas. Amputations are the most difficult decision regarding crush injuries despite their life-saving aspect (13). In this present study, the extremities were the most injured anatomic part and needed to be amputated in two patients.

Study Limitations

The present study had several limitations. Firstly, the case series were retrospective in nature and secondly, there could have been a lack of record keeping or incomplete record keeping among the parents or other family members.

Conclusion

Earthquakes are natural disasters with the potential of causing death and homelessness. On February 6th, 2023, a large number of people and children who had been trapped under rubble needed a thorough evaluation, and most of those pulled from under the rubble were unfortunately admitted to hospitals as deceased. It is not possible to predict where and when earthquakes will occur or their severity despite todays' technological improvements. In order to avoid unfavorable consequences during earthquakes and earthquake-related deaths and injuries, policies for preparedness, response, emergency response systems, and disaster loss reduction strategies should be planned and implemented by government institutions.

Acknowledgments

We thank the general pediatrics clinic staff for contributing in the application of this survey.

Ethics

Ethics Committee Approval: Ethics committee approval was obtained from the Ege University Faculty of

Medicine Clinical Research Ethics Committee (approval no: 23-6.1T/44, date: 06.07.2023).

Informed Consent: Informed consent with verbal consent was taken from the participants' parents.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Ş.G., B.E.D., B.A., Concept: Ş.G., B.E.D., Design: Ş.G., B.E.D., Data Collection or Processing: B.E.D., B.A., Analysis or Interpretation: Ş.G., B.E.D., Writing: Ş.G., B.E.D.

Conflict of Interest: No conflict of interest is declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Ministry of Interior Disaster and Emergency Management Presidency. Press bulletin 01.03.2023 about the earthquake in Kahramanmaraş- 36. https://en.afad.gov.tr/pressbulletin-36-about-the-earthquake-in-Kahramanmaras. Accessed March 2, 2023.
2. Guner S, Guner SI, Isik Y, et al. Review of Van earthquakes form an orthopaedic perspective: a multicentre retrospective study. Int Orthop 2013; 37:119-24.
3. Medical Efforts and Injury Patterns of Military Hospital Patients Following the 2013 Lushan Earthquake in China: A Retrospective Study. Int J Environ Res Public Health 2015; 12:10723-38.
4. The International Disasters Database. Centre for Research on the Epidemiology of Disasters. Available from: https://www.emdat.be/publications/
5. AFAD. Türkiye'de Afet Yönetimi ve Doğa Kaynaklı Afet İstatistikleri. Available from: https://www.afad.gov.tr/kurumlar/afad.gov.tr/35429/xfiles/turkiye_de_afetler.pdf
6. Kahramanmaraş Deprem Raporu. Available from: https://www.researchgate.net/publication/370003182_Kahramanmaras_Deprem_Raporu
7. Jiang J, Li Y, Huang X, et al. Lessons learnt from the Wenchuan earthquake: performance evaluation of treatment of critical injuries in hardest-hit areas. J Evid Based Med 2012; 5:114-23.
8. Arango-Granados MC, Cruz Mendoza DF, Salcedo Cadavid AE, García Marín AF. Amputation in crush syndrome: A case report. Int J Surg Case Rep 2020; 72:346-50.
9. Peng Kang, Bihan Tang, Yuan Liu, et al. Medical Efforts and Injury Patterns of Military Hospital Patients Following the 2013 Lushan Earthquake in China: A Retrospective Study. Int J Environ Res Public Health 2015; 12:10723-38.
10. Mulvey JM, Awan SU, Qadri AA, Maqsood MA. Profile of injuries arising from the 2005 Kashmir earthquake: the first 72 h. Injury 2008; 39:554-60.
11. Bulut M, Fedakar R, Akkose S, Akgoz S, Ozguc H, Tokyay R. Medical experience of a university hospital in Turkey after the 1999 Marmara earthquake. Emerg Med J 2005; 22:494-8.
12. Moitinho de Almeida M. "Recovering, not recovered" Hospital disaster resilience: a case-study from the 2015 earthquake in Nepal. Glob Health Action 2022; 15:2013597.
13. Pan ST, Cheng YY, Wu CL, et al. Association of injury pattern and entrapment location inside damaged buildings in the 2016 Taiwan earthquake. J Formos Med Assoc 2019; 118311-23.