J Pediatr Res 2023;10(4):244-8
DOI: 10.4274/jpr.galenos.2023.71363

Review

The Devastating Turkey-Syria Earthquake from the Perspective of Pediatric Nephrology

Sevgin Taner[1], Yılmaz Tabel[2], Sevcan A. Bakkaloğlu[3]

[1]Adana City Training and Research Hospital, Clinic of Pediatric Nephrology, Adana, Turkey
[2]İnönü University Faculty of Medicine, Department of Pediatric Nephrology, Malatya, Turkey
[3]Gazi University Faculty of Medicine, Department of Pediatric Nephrology and Rheumatology, Ankara, Turkey

ABSTRACT

Kahramanmaraş was hit by two major earthquakes nine hours apart on February 6th, 2023, with magnitudes of 7.8 and 7.5 on the Richter scale, respectively. Ten other cities were also devastatingly affected by these earthquakes. More than 50 thousand people died in Turkey. The occurrence of two severe earthquakes on the same day in such a wide geographical area caused significant challenges. This disaster, with its devastating effects, focused attention on the significance of establishing a national and comprehensive emergency disaster plan prior to any disaster. Additionally, it highlighted the necessity of preparing a well-organized healthcare team capable of providing prompt and appropriate fluid replacement for pediatric patients in the early stages of a disaster. This is a crucial issue which must be addressed prior to major disasters. Another very important issue in this tragic disaster was the condition of chronically ill pediatric patients. Indeed, an emergency response is important not only for disaster victims, but also for those patients with chronic diseases in need of uninterrupted medical care. It is vital that individuals of all ages, as well as personnel from all sectors, receive the appropriate education, awareness, and knowledge on what actions to take, where to go, and where to gather in such situations.

Keywords: Earthquake, disasters, children, crush syndrome, crush injury

Introduction

Kahramanmaraş, which is located in the southeastern part of Turkey, was hit by two major earthquakes nine hours apart on February 6th, 2023, with magnitudes of 7.8 and 7.5 on the Richter scale, respectively. Ten other cities were also devastatingly affected by these earthquakes (1). As a result of these earthquakes, more than 50 thousand people died in Turkey, more than 8 thousand people in Syria lost their lives, and more than 122 thousand people were injured in total (2). The two major earthquakes caused damage to an area of approximately 350,000 km^2 and affected 14 million people, which represents 16% of Turkey's population. At the same time, severe winter conditions prevailed in the first days after the earthquake. The occurrence of two severe earthquakes on the same day in such a wide geographical area caused significant challenges. As in the 1999 Great Marmara earthquake, damaged roads and airports initially hindered rescue efforts, but urgently needed personnel and supplies were transported via ships and military helicopters (3).

To provide a clearer understanding of the situation, we wish to consider the case of a pediatric earthquake victim who was brought to a state hospital in the earthquake zone 18 hours after the event. A 16-year-old male patient presented to Adana City Hospital's Emergency Department

Address for Correspondence
Sevgin Taner, Adana City Training and Research Hospital, Clinic of Pediatric Nephrology, Adana, Turkey
Phone: +90 505 312 07 78 E-mail: sevgintaner@gmail.com ORCID: orcid.org/0000-0003-1578-789X
Received: 01.06.2023 **Accepted:** 08.08.2023

18 hours after the earthquake. He had been rescued from the rubble by his family at the 14th hour and transported by ambulance with the assistance of the national professional medical team. It was noted that an unknown amount of isotonic saline had been administered to the patient during transport. His weight was 70 kg (50th-75th percentile), his height was 172 cm (25th-50th percentile), his blood pressure was 110/70 mmHg, and his body temperature was 36°C. Upon physical examination, diffuse hematoma, ecchymoses, edema and wound defect were observed in both distal lower extremities, extending up to the knees. Superficial abrasions were also present on the trunk and right arm. No fracture was detected.

The patient's hemogram showed hemoconcentration, with a hemoglobin level of 21 g/dL, white blood cell count of 36x10^3/µL and thrombocyte count of 218x10^3/µL. Biochemical analysis revealed acute kidney injury, with a urea level of 58 mg/dL, creatinine of 2.59 mg/dL, and uric acid of 8.8 mg/dL, as well as crush syndrome, with aspartate aminotransferase levels of 1,911 U/L, alanine aminotransferase levels of 455 U/L, creatine kinase (CK) levels of 142.560 U/L, CK-MB levels of 1,650 U/L, and LDH levels of 8,066 U/L. The patient also had an electrolyte imbalance, with a sodium level of 129 mmol/L, potassium levels of 4.8 mmol/L, calcium levels of 7.3 mg/dL, and phosphorus levels of 6.9 mg/dL. Coagulation parameters were normal. The patient's urine output was 0.08 mL/kg per hour, and the urine color was brown. In the emergency room, the patient received an isotonic saline bolus, followed by 2,500 cc/m^2 per day of ½ isotonic alkalized solution (50 mEq/L $NaHCO_3$). The patient's admission and follow-up laboratory data, along with his clinical course, are presented in Table I. This 16-year-old and about 1,000 other children in

Table I. The patient's admission and follow-up laboratory data and clinical progress

	Day 0 06.02	**Day 2 08.02**	**Day 3 09.02**	**Day 10 16.02**	**Day 14 20.02**	**Day 20 26.02**	**Day 37 16.03**	**Day 42 22.03**
Hemoglobin (g/dL)	21.2	18.2	11.8	6.7	8.1	10.4	10.4	9.7
Platelets (x10^3/µL)	218	158	113	101	113	218	483	368
WBC (x10^3/µL)	36	32.8	22.1	18.1	20	10.3	13.9	11.9
Urea (mg/dL)	49	110	154	148	120	74	46	39
Creatinine (mg/dL)	1.79	4.1	4.6	6.8	7.9	4.1	0.75	0.60
Uric acid (mg/dL)	8.8	12.2	8.9	6.4	8.7	5.9	6.6	6.5
Sodium (mmol/L)	129	124	130	136	125	131	138	137
Potassium(mmol/L)	4.8	8.2	6.2	4.4	3.8	3.8	4.06	4.6
Calcium (mg/dL)	7.3	6.9	8.5	8.1	7.5	7.9	10.5	9.8
Phosphorus (mg/dL)	6.5	11.4	9.3	3.3	4.2	4.4	4.4	4.5
Albumin (g/L)	3.3	2.3	2.4	2.0	2.8	2.8	2.9	3.1
AST (U/L)	1,911	1,740	1,854	158	41	28	20	23
ALT (U/L)	713	701	393	47	19	7	20	26
LDH (U/L)	1,650	6,704	4,096	594	363	376	255	191
CK (U/L)	142,560	166,950	120,010	2,180	880	580	228	-
CK-MB (U/L)	8,066	1,650	1,400	118	19	24	20	-
CRP (mg/L)	96	152	96	16	38	14	27	18
Urinalysis (HPF)	-	-	-	-	25E/20L	14E/13L	38E/7L	5E
Urine pr/cr (mg/mg)	-	-	-	-	2.69	2.29	0.96	0.52
UO (mL/kg per hour)	0.08	0.23	0.20	0.37	0.7	2.1	2.2	1.7
Intervention	Fasciotomy	PICU	Amp	Inpatient clinic	Stump repair			
Kidney replacement treatment	-	Yes (CRRT)	Yes (CRRT)	Yes (IHD)	Yes (IHD)	Yes (Last IHD)	Renal recovery	-

WBC: White blood cell, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, LDH: Lactate dehydrogenase, CK: Creatine kinase, UO: Urine output, HPF: High power-field, PICU: Pediatric intensive care unit, Amp: amputation, CRRT: Continuous renal replacement therapy, IHD: Intermittent hemodialysis

similar conditions were transported to hospitals both in the earthquake region and all over Turkey, with varying degrees of injury findings.

Earthquakes cause widespread human, material, economic and environmental losses (4). It has been reported that approximately 1 billion children under the age of 14 live in countries with high seismic risk (5). Child patients face additional difficulties during disasters. Losing their parents and other close relatives can make them feel incredibly lonely and disrupt their mental state. In normal times, children can easily receive medical care with the help of their parents, but in disasters, they may face challenges both psychologically and medically. During normal times, even parents may find it difficult to have their child's blood taken for diagnostic purposes, while in this catastrophic period, it may be necessary to obtain the children's consent to amputate their limbs in order to save their life.

In the 1988 Armenian earthquake, dubbed the "kidney disaster", approximately 600 victims who were rescued alive from the rubble developed acute kidney injury (6). In this review, the Gölcük earthquake and other disasters in our country are also extensively mentioned (7). In the most recent earthquake in Turkey, in addition to the devastating consequences of the earthquake, in the first month following the earthquake, heavy rains caused dozens of fatalities in three earthquake-stricken cities due to flood disasters.

It was seen that the majority of the patients who came in the first hours following the earthquake came by their own means. This indicates that those patients arriving within the first few hours after the earthquake require significant surgical intervention and that professional medical team intervention is lacking or inadequate. These patients are typically removed from the rubble immediately and have fewer crush injuries than expected. Patients who do not have an IV line, who have not received fluid replacement, whose vital signs are unknown, and who do not have identity cards may be encountered. In the following hours and days, such patients are superseded by more severely crushed patients, those who have been removed from collapsed structures by professional teams, who have vascular access and whose fluids have been started. At this point, these patients require the rapid insertion of an HD catheter and intensive dialysis. However, this must be performed with limited equipment and staff, and in facilities which have been damaged by the earthquake (8). The Turkish Society of Pediatric Nephrology (TSPN) took responsibility from the early hours of the disaster in Kahramanmaraş located in southeastern Turkey on February 6th, 2023 and became a part of the effort with other stakeholders. Rapid communication was established with the disaster area. The Crush Syndrome Initial Guidelines for children (9) and another guideline for neonates were prepared in collaboration with the Turkish Neonatology Association (10). Needs such as pediatric nephrologists, dialysis machines, catheters, dialysis supplies and medications were determined and provided with the coordination of the Disaster and Emergency Management Presidency and Ministry of Health officials. Ten volunteer pediatric nephrologists served in shifts in the earthquake affected zone.

Due to the nature of this earthquake, patients were rescued from the debris even after 10 days. Interestingly, crush injuries were less common in those patients who were rescued after the 5th or 7th day. This is probably because these patients were not severely traumatized, and dehydration was less developed in the cold weather present at that time.

Another very important issue in this tragic disaster was the condition of chronically ill pediatric patients (11). Indeed, an emergency response was important not only for disaster victims, but also for those patients with chronic diseases in need of uninterrupted medical care. We referred these patients to centers outside of the earthquake zone because of damaged houses, and difficulties in accessing care delivery or medications, dialysis fluids, and equipment. Even if they are able to access care facilities, they may be unable to find the doctors and healthcare professionals with whom they had previously been in contact with. Furthermore, during these times of crisis, cuts in transportation, electricity, natural gas, or water, and perhaps most importantly, communication can impede planning and treatment efforts (12).

This disaster, with its devastating effects, revealed the significance of establishing a national and comprehensive emergency disaster plan prior to any disaster. Additionally, it highlighted the necessity of preparing a well-organized healthcare team capable of providing prompt and appropriate fluid replacement for pediatric patients in the early stages of a disaster. This is a crucial issue which must be addressed prior to any major disasters. It is vital that individuals of all ages, from young children to the elderly, as well as personnel from all sectors, receive the appropriate education, awareness, and knowledge on what actions to take, where to go, and where to gather in such situations (13).

The International Society of Nephrology announced the theme for the 2023 World Kidney Day as "Kidney Health

for All" with the motto "Preparing for the unexpected, supporting the vulnerable!" (14). This message emphasizes the importance of including groups such as children in disaster preparedness plans. To this end, in order to increase awareness of earthquake preparedness and to manage earthquake-related medical and psychological problems, the İstanbul branch of the TSPN organized two meetings one week apart (15). Supporting medical teams during disasters is another important area which deserves much more attention. For this purpose, a meeting was held with the participation of the European Society for Paediatric Nephrology (ESPN) Disaster Taskforce, and online free registration support of the ESPN Congress was granted for pediatric nephrologists who worked in the EQ zone.

In disasters, it is crucial to have a comprehensive plan in place. Starting with the most vulnerable unit, the family, it is critical for each agency to have its own trauma team, management plan, and clearly defined allocation of responsibilities, including where to be and what to do in the event of an earthquake. It is also crucial to designate individuals responsible for record-keeping procedures, especially in healthcare settings (16). Collecting patient records is vital in order to correctly manage current and future disaster events. Therefore, a web-based data collection system was created by the TSPN, and its first results are being analyzed (17).

After such major disasters, many children are at risk of contracting infectious diseases such as diarrhea, pneumonia and scabies, and acute malnutrition, which can create a vicious cycle between the two. Some have lost limbs and will require lifelong physical rehabilitation, mental health care, as well as socioeconomic support. Others have lost their parents and homes, schools, and support systems, which can disrupt their daily lives and increase the risk of school dropout, mental health problems, child marriages, adolescent pregnancy, abuse, and violence in the long term. Additionally, earthquakes cause environmental pollution, including asbestos exposure from demolished older buildings, which is expected to have an impact especially on children (18).

Conclusion

In conclusion, disasters such as earthquakes are inevitable for some geographical areas and can occur unexpectedly, leaving vulnerable populations, such as children, particularly susceptible to the negative impacts of these events. Even if these children survive, they may experience early and long-term physical and social traumas. Therefore, it is crucial that medical professionals, including pediatricians, child psychiatrists, infectious disease specialists, and surgeons, are educated about the specific hazards these patients may face during disasters and they plan how and where they will work during such disasters.

Ethics

Peer-review: Internally and externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: S.T., Concept: Y.T., S.B., Design: Y.T., S.B., Data Collection or Processing: S.T., Analysis or Interpretation: Y.T., S.B., Literature Search: Y.T., S.B., Writing: S.T., Y.T., S.B.

Conflict of Interest: None of the authors had any conflicts of interest.

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

References

1. https://www.trthaber.com/haber/turkiye/kahramanmarasta-74-buyuklugunde-deprem-76-kisi-yasamini-yitirdi-743723.html
2. https://tr.wikipedia.org/wiki/2023_Kahramanmara%C5%9F_depremleri
3. Düzova A, Akgül S, Utine GE, Yıldız Y. The Türkiye-Syria Earthquake: a response from the editors of the Turkish Journal of Pediatrics. Turk J Pediatr 2023; 65:1-2.
4. Avaliable at: https://www.undrr.org/terminology/disaster.
5. Sever MS, Sever L, Vanholder R. Disasters, children and the kidneys. Pediatr Nephrol 2020; 35:1381-93.
6. The United Nations Children`s Fund (UNICEF) and The United Nations International Strategy for Disaster Risk Reduction (UNISDR). Children and disasters: Building resilience through education. https://www.unisdr.org/we/ inform/ publications/24583.
7. Dönmez O, Meral A, Yavuz M, Durmaz O. Crush syndrome of children in the Marmara Earthquake, Turkey. Pediatr Int 2001; 43:678-82.
8. Ukai T. The Great Hanshin-Awaji Earthquake and the problems with emergency medical care. Ren Fail 1997; 19:633-45.
9. https://www.cocuknefroloji.org/site/. Last accessed on the 10th of March, 2023.
10. http://www.neonatology.org.tr/wp-content/uploads/2023/02/TND-DEPREM-BOLGESI-YENIDOGAN-BAKIM-REHBERI-SON-15.02.2023.pdf. Last accessed on the 10th of March, 2023.
11. Sever L, Balat A. Renal crisis in children during armed conflict. Semin Nephrol 2020; 40:408-20.
12. Canpolat N, Saygılı S, Sever L. Earthquake in Turkey: Disasters and Children. Turk Arch Pediatr 2023; 58:119-21.
13. Sever L, Pehlivan G, Canpolat N, et al. Management of pediatric dialysis and kidney transplant patients after natural or man-made disasters. Pediatr Nephrol 2023; 38:315-25.

14. Available at: https://www.worldkidneyday.org/2023-campaign/2023-wkd-theme/?gclid.

15. Available at: https://turkpediatri.org.tr/haberler/turk-pediatri-kurumu-ve-cocuk-nefroloji-dernegi-ortakliginda-cocuk-nefroloji-gozuyle-afetler-konulu-online-sempozyum-gerceklestirildi-26

16. Terzi Ö, Dündar C. The problem of unaccompanied children in the earthquake; insufficient enrollment. Disaster Med Public Health Prep 2023; 21:1-6.

17. https://deprem.cnd-rrt.org/. Last accessed on the 26th of March, 2023

18. Kappy B, Parish A, Barda A, Frost P, Timm N. Pediatric-Specific Hazard Vulnerability Analysis: The Missing Component of Regional and Hospital-Based Preparedness. Disaster Med Public Health Prep 2022; 17:e199.