

ORIGINAL ARTICLE

Lessons Learned from Crisis Management and Amputation Decisions in the Aftermath of High-magnitude Earthquakes in Kahramanmaraş on 6 February 2023

6 Şubat 2023 Kahramanmaraş'ta Yaşanan Büyük Deprem Sonrasında Kriz Yönetimi ve Ampütasyon Kararlarından Alınan Dersler

¹Atilla Orhan 

¹Selcuk University Faculty of Medicine
Dept. of Cardiovascular Surgery

Correspondence

Atilla Orhan, Selcuk University Faculty of Medicine, Dept. of Cardiovascular Surgery

E-Mail: atillaorhan@gmail.com

How to cite ?

Orhan A. Lessons Learned from Crisis Management and Amputation Decisions in the Aftermath of High-magnitude Earthquakes in Kahramanmaraş on 6 February 2023. Genel Tıp Derg. 2024;34(1):119-123.

ABSTRACT

Introduction: Earthquakes of high magnitude and prolonged duration result in catastrophic events, causing significant loss of life and property. Immediate medical interventions become crucial in the aftermath of such disasters to prevent long-term disabilities and fatalities. This study focuses on the challenges faced by a volunteer medical team in Kahramanmaraş, Türkiye, after two major earthquakes struck on February 6, 2023, affecting millions of people.

Methods: A team of 35 experienced medical professionals, led by a cardiothoracic surgeon, was dispatched to the disaster site. The team's schedule, tasks, and logistical details were organized to optimize their response. The study outlines the methods employed by the team to assess and treat extremity traumas, including amputations during the first-week post-earthquake.

Results: The earthquake severely impacted local healthcare facilities, resulting in inadequate patient management, insufficient medical personnel, and logistical difficulties. The volunteer team worked tirelessly, performing surgeries and amputations and providing medical equipment. A total of 16 lower limb amputations and two upper limb amputations were performed due to severe extremity crush injuries.

Discussion: The chaotic conditions post-earthquake revealed challenges in managing crush syndrome patients. The study discusses the decision-making process for amputations, fasciotomies and patient transfers. Despite limited facilities, the team restored the hospital to full functionality within a few days.

Conclusion: The study concludes that volunteer healthcare teams are crucial in disaster response. Effective organization, communication, and logistics are essential for optimal performance. Continuous training on disaster scenarios for volunteer teams is recommended. The importance of restoring healthcare facilities to routine operation after immediate crisis response is emphasized, as well as the need for comprehensive scientific data to understand the extent of the disaster's impact.

Keywords: Earthquake, disaster, volunteer health workers, fasciotomy, amputation, crisis management

ÖZ

Giriş: Büyüklükleri ve süreleri uzun olan depremler büyük felaketlere yol açarak önemli insan ve malzeme kayıplarına yol açmaktadır. Bu tür felaketlerin ardından, uzun süreli sakatlıkların ve ölümlerin önlenmesi için acil tıbbi müdahaleler hayati önem taşıyor. Bu çalışma, 6 Şubat 2023'te meydana gelen ve milyonlarca insanı etkileyen iki büyük depremin ardından Kahramanmaraş'ta gönüllü bir sağlık ekibinin karşılaştığı zorluklara odaklanıyor.

Yöntemler: Afet bölgesine, kalp-damar cerrahinin liderliğindeki 35 deneyimli tıp uzmanından oluşan bir ekip gönderildi. Ekibin programı, görevleri ve lojistik ayrıntıları, yanıtlarını optimize edecek şekilde düzenlendi. Çalışma, depremden sonraki ilk hafta boyunca amputasyonlar da dahil olmak üzere ekstremitre travmalarını değerlendirmek ve tedavi etmek için ekip tarafından kullanılan yöntemleri özetlemektedir.

Sonuçlar: Deprem yerel sağlık tesislerini ciddi şekilde etkileyerek yetersiz hasta yönetimine, yetersiz tıbbi personele ve lojistik zorluklara neden oldu. Gönüllü ekip yorulmadan çalıştı, ameliyatlara ve amputasyonlara gerçekleştirdi ve tıbbi ekipman sağladı. Ağır ekstremitre ezilme yaralanmaları nedeniyle toplam 16 alt ekstremitre amputasyonu ve iki üst ekstremitre amputasyonu gerçekleştirildi. Tartışma: Deprem sonrası kaotik koşullar, ezilme sendromlu hastaların tedavisindeki zorlukları ortaya çıkardı. Çalışma amputasyonlar, fasyotomiler ve hasta transferleri için karar verme sürecini tartışıyor. Ekip, sınırlı tesislere rağmen birkaç gün içinde hastaneyi tam işlevselliğe kavuşturdu.

Sonuç: Çalışma, gönüllü sağlık ekiplerinin afet müdahalesinde çok önemli olduğu sonucuna varıyor. Optimum performans için etkili organizasyon, iletişim ve lojistik şarttır. Gönüllü ekiplerin afet senaryoları konusunda sürekli eğitim alması tavsiye edilir. Acil kriz müdahalesinin ardından sağlık tesislerinin rutin operasyonlara döndürülmesinin önemini yanı sıra, felaketin etkisinin boyutunu anlamak için kapsamlı bilimsel verilere duyulan ihtiyaç da vurgulanıyor.

Anahtar kelimeler: Doğal afetler, Deprem, Kriz yönetimi, Gönüllü sağlık çalışanları, Ekstremitre kurtarma, Ampütasyon, Fasyotomi

Introduction

High-magnitude and prolonged earthquakes affect many individuals. Housing, heating, food, and water supplies may become critical during the acute phase of the event. Large-scale disasters such as major earthquakes engender immediate fatalities and represent catastrophic events with significant loss of life and property. Fatality rates can be staggering, while long-term temporary or permanent disabilities

a cohort of severely injured victims who are often extricated from the rubble through all efforts (Ardagh 2012).

Survivors extricated from debris face a high risk of experiencing multiple traumas, particularly in major extremities, leading to catastrophic conditions such as crush syndrome with severe clinical implications. Therefore, rapid evaluation of extremity trauma is crucial to prevent the onset of crush syndrome. However, healthcare facilities with limited resources often lack the means for hemodialysis, presenting a significant challenge for vascular and trauma surgeons tasked with making complex and far-reaching decisions regarding amputation. Such decisions entail a difficult balance between the patient's survival and the risk of lifelong disability resulting from amputation (Ardagh 2012, Vanholder 2007).

On 6 February 2023, two major earthquakes with magnitudes of 7.7 and 7.6 on the Richter scale struck Kahramanmaraş, affecting at least ten provinces and approximately 20 million people. The earthquakes deeply impacted Türkiye's southern neighbor, Syria, and were felt across a wide area extending to Egypt. The scale of the disaster was extraordinary, with the death toll reaching 32,000 and the number of injured 90,000 in the first seven days. Initial assessments indicate that around 15,000 buildings were destroyed in the affected cities, and the remaining structures, as well as roads and airports, suffered varying degrees of damage. The large area affected and the millions of people impacted, coupled with the extensive damage to transportation infrastructure, posed a logistical challenge to the disaster response, hindering the efforts of first responders and official authorities (AFAD 2023, Utkucu 2023).

Kahramanmaraş (Türkiye), with a population of approximately 380,000, is located in the mountains in the middle of other provinces (4). Transportation difficulties due to the winter season and bad weather conditions such as heavy snow and rain made it challenging to provide immediate medical intervention, evacuation, rescue, and primary care material distribution to the affected victims. Air transportation to the region was also disrupted. As a result, it took more than 12 hours for the rescue teams to reach the remote disaster areas, and it was also challenging to access the mountainous settlements within the first 24 hours.

In this century's major disaster with severe consequences, shortly after the event, medical aid volunteers from our university's medical faculty, who quickly coordinated, discussed the challenges of our initial transportation difficulties from Konya, approximately an 8-hour drive from the incident site, our organization on the road and in the region, and our decisions for extremity trauma in the first week as vascular and trauma surgery teams.

Methods

Our team consisted of an experienced medical team of 35 people. The team leader, a cardiothoracic

surgeon, led the team for one week. The organization chart of our volunteer healthcare team is given in Table-1. Our team's schedule until their return after the event and the information they reached what point and when are given in Table-2. The team lists created were delivered to the coordination units of the Ministry of National Health, and necessary permits and travel reservations were made. Due to the weather conditions allowing access to the border by road, it was decided to trip the high-speed train out of the province of Konya in the direction of the capital Ankara. Our team reached Ankara, and the government authorities transported us to the airport by road. We arrived at Gaziantep airport with volunteer teams departing from other provinces with a scheduled flight, which our official institutions at Esenboğa airport held. Unfortunately, medical and non-healthcare teams from many areas created heavy traffic at the airport and delayed our arrival at the final destination. From there, it was tough to reach Kahramanmaraş by road under heavy snow and rain. Finally, we arrived at Kahramanmaraş national emergency coordination center. We learned our duty, and we were able to reach Necip Fazıl Kısakürek Maternity and Children's Hospital, which is one of the three hospitals in the city that survived without collapse on 07.02.2023 at 03:30. As our team was prepared for all kinds of scenarios in the disaster area throughout the journey, as soon as we arrived, we took over the target hospital from the local teams and started working.

Results

We worked with our volunteer team from 07.02.2023 at 03:30 until February 11, 2023, at 14:00 at the hospital. Our first impressions were that the local healthcare team could not perform their duties adequately due to the effects of the earthquakes, their numbers were missing, and they were in shock and had post-traumatic findings. Natural gas was unavailable. Local healthcare personnel and patients were severely exposed to cold due to a -10°C cold. The electrical system was active.

The hospital consisted of a ground floor, three floors, and two adjacent buildings. The services floor had been closed. All the victims were in the hallway on the ground floor at the hospital entrance. Many inpatients from other hospitals that were destroyed or severely damaged had also been transferred here. The number of patients was well above capacity. The operating rooms were on the 2nd floor, and the delivery room and intensive care units were on the 3rd floor. As planned, our volunteer team took their positions. Patient examination, triage, and surgeries were initiated. After the first examination and triage, the patients were divided into two groups, trauma patients and others, and they were deployed at different points in the hospital. The patients to be operated on were transferred to the operating room. For about five days, we performed surgeries for extremity traumas in the disaster area (Table-3). The hospital infrastructure allowed us to perform hemograms, arterial blood gas, and CT scan examinations. Our team leader, an

emergency specialist, made the first admission of the patients who came to the emergency department. And patients were divided into two groups; those requiring medical treatment and those requiring surgical treatment.

Extremities were evaluated with vascular hand doppler ultrasound. For patients with deep acidosis, severe crush findings in their extremities, deep acidosis in arterial blood gas, severely damaged tissue integrity, and high trauma score prone to hyperkalemia, the amputation decision was made without waiting after obtaining written consent from them and their relatives. Sixteen patients underwent lower limb amputations. Two patients underwent upper extremity amputation. A left upper extremity with multiple open fractures and no circulation was revascularized with an autogenous graft. Unilateral or bilateral fasciotomy was performed on 47 patients with mild to moderate extremity crush injuries. Two days after the fasciotomy, one patient required amputation due to a deteriorating general condition (Table-3). We suggested amputation for a 2-year-old boy with bilateral lower limb extremity crushing, but his family did not accept the surgery. He died while transferring to another center was planned. The patient transfer problem was resolved on February 8th. The patients were transferred to hospitals in other regions unaffected by the earthquake. We were informed that a transferred patient died due to multi-organ failure.

In the first stage, we provided the medical and surgical equipment needed by transporting them from another damaged hospital. This equipment included two operating tables, a C-arm fluoroscopy device, a mobile aspirator, a cautery device and a dialysis machine. With these added materials to the existing infrastructure in the hospital, we have a more functional operating room and intensive care units. Finally, at the end of the second day of the earthquake, medical supplies began to arrive at the hospital.

With the participation of newly arrived volunteers, we created six-hour work shifts and allowed the teams to rest. One of our biggest problems was the accumulated garbage and hospital hygiene. To solve this problem, our volunteer teams cleaned during their rest time. This experience gave us the idea to include volunteer cleaning staff in our team in a subsequent disaster. We had created a functional and coordinated hospital environment by the end of the fourth day. We decided to transfer our duties to new volunteer healthcare teams as the Ministry of Health directed new teams to the hospital, and our team was tired and sleepless. We delegated the patients and our experiences to the new volunteer healthcare teams. And we left the disaster area on February 11, 2023, at 14:00. On the fifth day following the earthquake, we departed from the affected region after successfully restoring a hospital to its previous level in less than a few days, despite the chaotic conditions.

Discussion

In the chaotic conditions after the February 6, 2023,

Kahramanmaraş earthquake, considered the most crucial global disaster of the century, the local healthcare and non-healthcare personnel needed help due to the influx of patients despite all their efforts. When we reached the local teams, they were not over the shock of the earthquake, and the patient management was out of control due to many patients. In addition, local logistics facilities needed to be improved due to the magnitude of the disaster (1,2).

This chaotic condition resulted in inadequate management of crushed patients. Most patients had exceeded the critical extremity recovery time and had very high trauma scores. For example, the Mangled Extremity Severity Score was more than 7 in most patients presenting with a limb crush.

Nevertheless, fasciotomy and revascularization attempts were tried first on the extremities that had a chance. A small number of patients were decided for radical amputation. Postoperative amputation was performed in one patient whose fasciotomy failed. Most patients requiring amputation and fasciotomy were in the lower extremities. Despite the limited number of active healthcare facilities in the vicinity, the number of crush syndrome patients admitted for treatment remained relatively low. Given the magnitude of the earthquake, we attribute the limited number of admissions to the possibility of a significant number of fatalities under the rubble.

We can summarize our impressions of the earthquake area as follows: The first earthquake caught people while they were asleep at night. Therefore, we hypothesize that large numbers of people die rapidly from complete crushing and that the crushing of limbs occurs in people who remain in their habitat. The second earthquake occurred at noon the next day, and survivors were near the buildings. As a result, we believe that they were exposed to head, neck, and chest traumas.

The most important cause of death in crush cases is rhabdomyolysis, caused by crushing large muscle masses, especially in the lower extremities, and the metabolic events caused by it. Metabolites that enter the blood rapidly can lead to different clinical scenarios, from acute renal failure to sudden cardiac arrest. This situation leads to many deaths in healthcare facilities that do not have advanced infrastructure such as hemodialysis and advanced intensive care services. In healthcare facilities with limited facilities in the disaster area, amputation, and fasciotomy are vital decisions that surgeons must make quickly to protect human life. When amputation or fasciotomy cannot be performed, death is inevitable if a referral is not possible. Amputation is a life-saving treatment if there is no possibility of further treatment and follow-up in extremities of cases whose metabolic and general conditions are poor and have been crushed under dents for more than six hours. Fasciotomy can be tried in suitable cases with less trauma and whose general

Table-1: Our volunteer health team organization chart

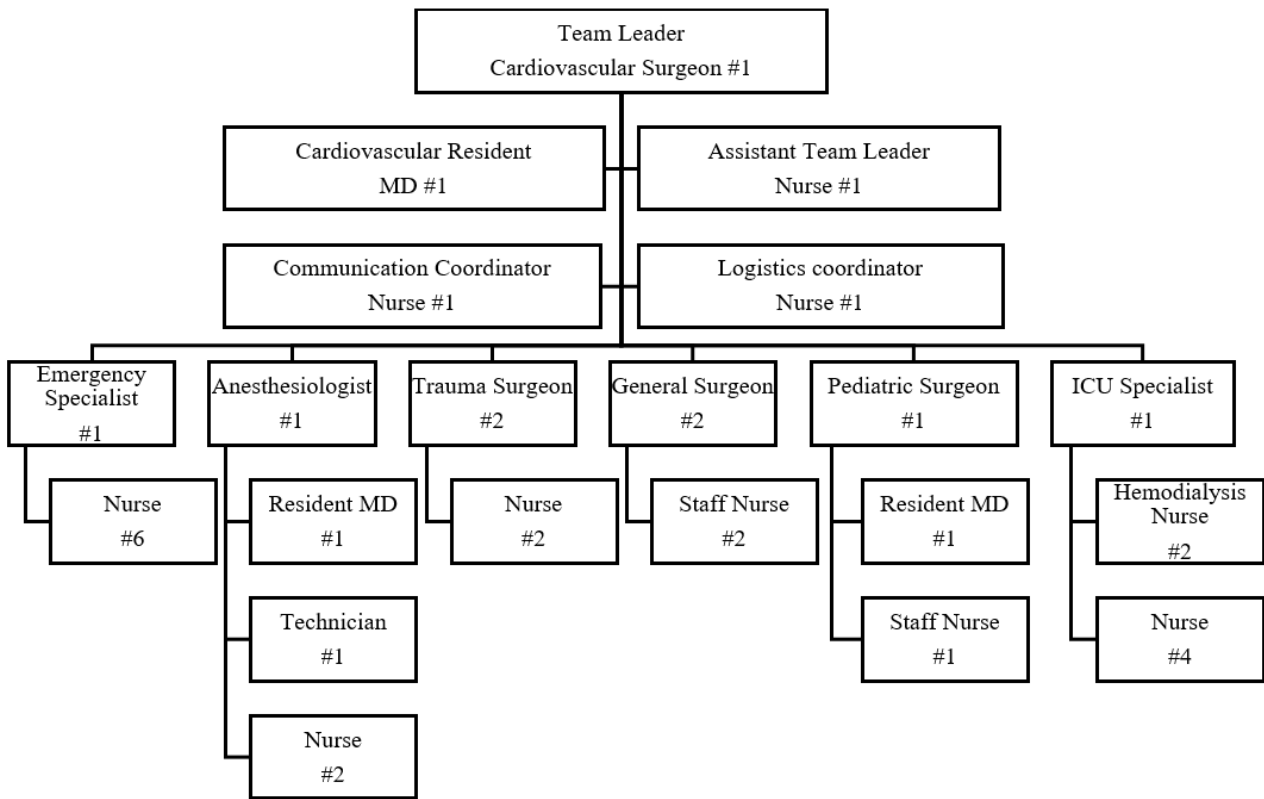


Table-2: Organization and Management Timeline for Our Volunteer Health Team

Code	Explanation	Date&Time
A	Extraordinary disaster coordination meeting	Feb 6 th , 09:00
B	Delivery of the Volunteer Team List to the Ministry of Health	13.30
C	Departure from Konya high-speed train station to Ankara	18:00
D	Flight from Ankara Esenboga airport to Gaziantep	23:30
E	Departure from Gaziantep to Kahramanmaraş by bus	Feb 7 th , 01:00
F	Arrival at the target hospital	04:00
G	First examination and triage	04:15
H	Transfer of triaged patients to the operating room, service rooms and intensive care units	05:30
I	Performing the first surgery	06:00
J	Coordination room organization	10:00
K	The arrival of other volunteer teams	11:00
L	Creation of routine work shifts	16:00
M	Initial water supply for crews	17:00
N	Initial food supply for crews	19:00
O	Establishment of additional patient rooms	Feb 8 th
P	Transfer of patients to safe hospitals	Feb 8 th
R	Institution of the first Hemodialysis system	Feb 9 th
Total stay of our volunteer team in Kahramanmaraş Target Hospital		5 days

Table-3: Distribution of life- and limb-sparing surgical interventions on the extremities

Procedure	Upper Limb			Lower Limb		
	Left	Right	Bilateral	Left	Right	Bilateral
Amputation	1	1	0	13	0	3
Fasciotomy	6	4	1	18	16	2
Revascularization	1	0	0	0	0	0
Arterial thrombectomy	0	0	0	0	1	0
Fracture Fixation	5	3	0	6	6	0
Tendon repair	0	0	0	0	1	0

condition is not affected much. However, amputation should still be preferred if the general condition deteriorates despite performing a fasciotomy in the postoperative follow-up.

In such major disasters, the volunteer healthcare teams that arrive at the scene must be well-organized and experienced. Moreover, they should also be provided with adequate logistical assistance, and a good communication platform should be established so that team members can work in harmony. Therefore, we think that healthcare teams who can communicate with national and international coordination centers and have sufficient pre-disaster experience will be more successful in case of disaster. In addition, when creating volunteer teams, appointing personnel to focus on the team's safety, shelter, nutrition, and technical needs can streamline operations in the disaster area. Efforts to transfer patients whose first

treatment was completed in the healthcare facility in the disaster area to hospitals in safe areas will prevent congestion and blockages in the healthcare facility.

Conclusion

This article reflects our team's experiences in the first week after the earthquake. We believe that the extent of the disaster will be understood better as time passes and more comprehensive scientific data is published. After lives and limbs are saved by volunteer teams, the previous working order of the healthcare facility should be restored, handed over to better-organized teams, and routine work re-established. Finally, we think volunteer teams should receive continuous training on possible disaster scenarios.

Ethical Consideration

All operations were carried out by the safety guidelines prepared for institutional and national policies and ethical standards and under emergency and challenging conditions in the disaster area. Local ethics committee approval was obtained for this retrospective study.

Acknowledgment

The author is grateful to all volunteer health workers who made extraordinary efforts in the Kahramanmaraş earthquake on February 6, 2023.

Conflict of Interests

The authors declare they have no conflicts of interest.

Funding Information

No funding was received to accomplish this work.

References

1. Ardagh, M. W., Richardson, S. K., Robinson, V., Than, M., Gee, P., Henderson, S., ... & Deely, J. M. (2012). The initial health-system response to the earthquake in Christchurch, New Zealand, in February, 2011. *The Lancet*, 379(9831), 2109-2115.
2. Vanholder, R., van der Tol, A., De Smet, M., Hoste, E., Koc, M. E. H., M. E. T., Hussain, A., ... & Sever, M. S. (2007). Earthquakes and crush syndrome casualties: lessons learned from the Kashmir disaster. *Kidney international*, 71(1), 17-23.
3. <https://www.afad.gov.tr/kahramanmaraş-pazarcikta-meydana-gelen-deprem-hk-basin-bulteni-9>
4. UTKUCU, M. (2023). A PRELIMINARY REPORT ON THE 2023 GAZİANTEP (Mw= 7.7) and ELBİSTAN (Mw= 7.5) EARTHQUAKES IN SOUTHEAST TÜRKİYE (Doctoral dissertation, Dumlupınar University).