ORIGINAL ARTICLE

Disaster area triage in the first 24 h of earthquakes, evaluation of pre-hospital and hospital procedures: 6.6 Elazig earthquake

Şükrü Yorulmaz, M.D.,[1] Semih Korkut, M.D.,[2] Figen Tunalı Türkdoğan, M.D.,[3] Kenan Ahmet Türkdoğan, M.D.[2]

[1]Ministry of Health General Directorate of Emergency Health Service, Ankara-*Türkiye*
[2]Department of Emergency Medicine, Health Sciences University, Başakşehir Çam and Sakura City Hospital, İstanbul-*Türkiye*
[3]Department of Radiology, İstanbul Physical Therapy and Rehabilitation Training and Research Hospital, İstanbul-*Türkiye*

ABSTRACT

BACKGROUND: Earthquakes are natural events, but the destruction they cause is quite high. Since it is not possible to prevent an earthquake, it is necessary to raise conscious and sensitive individuals about earthquakes and to seek solutions. It was aimed to present the triage, consumables, fluids, and drugs used in the 2020 Elazig earthquake.

METHODS: After the earthquake, the epicenter of which was Sivrice/Elazig on January 24, 2020, all affected victims, pre-hospital triage status, management of emergency, and other inpatient services during the hospitalization, medical interventions including surgeries, consumables, fluids, and drugs were evaluated retrospectively with the data in the first 24 h.

RESULTS: The total number of injured after the earthquake in Elazig, which had a magnitude of 6.6 on the Richter scale and lasted for 22 s, was 974. While 37 (3.7%) people died, 18 (1.8%) of them were women. While 34 people died in the wreckage and 3 people in the emergency department, their mean age was 46.0±12.5 years. While 654 patients were registered in the first 24 h, 30 of them were by 112 Command and Control Center and 624 were outpatients. Temporary registration was provided to 320 people as they did not have their identity information.

CONCLUSION: Being prepared and organized before an earthquake, and taking early intervention will provide significant success in the survival of the disaster victims.

Keywords: 112 command and control center; earthquake; Elazig; medical supplies; triage.

INTRODUCTION

There are more than 1 million earthquakes in the world every year, with a new earthquake occurring approximately every 2 min.

Turkey is among the countries that are frequently faced with disasters, especially earthquakes.[1] According to natural disasters in the past 60 years, 2/3 of the population in our country is in the earthquake zone and 98% of the population is under the risk of earthquakes, and 65% of them are under priority risk.[2,3] In large earthquakes with a large number of injured, significant health-care needs arise within the first 24–48 h.[4]

Disaster area and hospital triage play an important role in emergency medical care.[5–8] Accurate and effective triage contributes to better patient outcome with timely and effective medical treatment.[9]

In the study, it was aimed to emphasize the importance of orientation in the circulation of search and rescue teams from the time of the first call to the removal of the last vic-

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Address for correspondence: Kenan Ahmet Türkdoğan, M.D.
Sağlık Bilimleri Üniversitesi, Başakşehir Çam ve Sakura Şehir Hastanesi, Acil Tıp Kliniği, İstanbul, Türkiye
Tel: +90 212 - 909 60 00 E-mail: drturkdogan@gmail.com

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tim from the wreckage in terms of mortality and morbidity, and to present the medical intervention analysis in the Elazig earthquake by evaluating the literature.

MATERIALS AND METHODS

On Friday, January 24, 2020, at 20:55, after the earthquake with a magnitude of 6.6 on the Rickter scale and lasting 22 s, the epicenter of which was in Sivrice/Elazig, 112 Command and Control Center (112 CCC). Starting from the first call, access to the first case and its transport, hospital treatment processes, audio recordings, examination of patients and 112 CCC files, and photographic images were evaluated retrospectively. According to these data, the disaster area triage, transport status, diagnosis, medical consumables, applied fluid resuscitation, and drugs were obtained from the hospital records.

Permissions were taken from Bakırköy Dr. Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (February 1, 2021 dated and 2021/74 numbered) and Provincial Health Directorate of Istanbul for this retrospective study.

Statistical Analysis

Data from this study were obtained from 112 CCC and hospital electronic record systems. The data were then analyzed with the SPSS 20 (SPSS Inc., Chicago, IL, USA) package program. Descriptive statistics were presented as mean±standard deviation or median (minimum-maximum) for continuous variables, and as number of cases and percentage (%) for nominal variables. Other data were analyzed using Microsoft Excel and simple descriptive statistics.

RESULTS

The total number of injured people after the earthquake in Sivrice/Elazig was 974. Sixty-four of whom came out of the wreckage, provided a total of 450 transports. The number of patients was 450. Thirty-four disaster victims died in the wreckage. Three people died in the hospital emergency department. Of the 974 patients admitted to hospitals, 654 (67.15%) were recorded. Temporary registration was provided because 320 (32.85%) people who were discharged did not have their identity information. The mean age of the victims was 40.2±18.8 years and 314 (48%) were women. A total of 37 (3.7%) people died, including 18 (1.8%) women, 34 in the wreckage, and three in the hospital emergency department. The mean age of all deaths was 46.0±12.5 years. In addition, there were no deaths during the inpatient unit and intensive care unit. The demographic data of the patients who applied in the first 6 h, 6–12 h, and 12–24 h are in Table 1.

In-hospital first interventions of all patients were performed in emergency services, 56 (5.74%) patients were transferred

Table 1. Demographic characteristics of patients admitted to the hospital according to time zones

	0–6 hours	7–12 hours	13–24 hours
Number of applications (n)	187	57	127
Average age (year)	41.3±19.4	40.5±15.0	38.4±12.3
Ambulance rate, n (%)	15 (8.0)	7 (12.3)	8 (6.3)
Hospitalization rate, n (%)	32 (17.1)	6 (10.5)	18 (14.2)
Intensive care unit hospitalization rate, n (%)	6 (3.2)	4 (7.0)	7 (5.5)

Table 2. Diagnoses of 30 patients who underwent surgical procedures

Body area	Diagnosis	n
Head-neck	Epidural hematoma/traumatic subarachnoid hemorrhage	2
Thoracic/lumbal vertebra	Lumbal 4 fracture	1
Abdominal	Liver laceration	1
Upper extremite	Right/left humerus fracture/compartment syndrome/fasciotomy	8
Lower extremite	Femur fracture/metatarsal fracture/calcaneal fracture/pelvis fracture	9
Burn	–	4
Crush syndrome	–	6
Falling from high	–	8
Other	Hypertension/syncope/chronic obstructive pulmonary disease/anxiety	5

*A total of 44 diagnoses were made in 30 patients.

to services and 17 (1.74%) patients were transferred to intensive care units. Medical interventions for hospitalized patients are shown in Table 2. Distribution of 73 patients followed in the hospital; pediatrics 1(0.3%), general surgery 5 (1.3%), chest diseases 4 (1.1%), neurosurgery 7 (1.9%), orthopedics 28 (7.6%), burns 3 (0.9%), neurology 2 (0.6%), internal medicine 6 (1.8%), internal medicine intensive care 4 (1.1%), general surgery intensive care 3 (0.6%), anesthesia intensive care 6 (1.8%), and neurosurgery intensive care 4 (1.1%).

When blood and blood product transfusions were evaluated, a total of 18 units of erythrocyte suspension were given to six patients and a total of 4 units of fresh frozen plasma were transfused to three patients.

The rates of drugs used in patients in the emergency department, inpatient unit, and operating room are shown in Table 3. Antibiotics and analgesics were the most commonly used drugs in inpatient services. Adrenaline, antibiotics, and tetanus were the leading drugs in the emergency department, while sedative drugs were in the first place in the operating rooms. When medical supplies are examined, their use according to the place of intervention (hospitalization, operating room, and emergency department, respectively) is shown in Table 4. The most frequently used materials in inpatient services were large lumen injectors and catheter materials. While cannulas, gloves, and nebula-oxygenation materials were used most in the emergency department, gloves and plaster materials were used frequently in the operating room. The distribution of the fluids used is shown in Table 5 for the service, operating room, and emergency, respectively. As expected, 0.9% saline was prominent everywhere.

DISCUSSION

According to the experience gained so far, emergency medical services are very important for the few days after the earthquake. During this time, emphasis should be placed on rescue and first aid. After the completion of this process, it remains to meet the needs of a society whose hygienic conditions are in distress and preventive health services are interrupted. In our study, which is different in that it is one of the few articles that examines the medical materials used, drugs, fluids, patient follow-up, and the first 24-h period, it is important to make earthquake preparedness as spontaneous as human walking.

People's acquaintance with earthquakes is as old as human history. In the earliest known records, information about earthquakes occurring in different parts of the world has been found. Millions of people died in these earthquakes. However, the effects of earthquakes do not produce similar

Table 3. Hospitalization, operating room and emergency drugs

Drugs	Hospitalization	Operating room	Emergency department
Antibiotic (intravenous/tablet)	26	–	16
Narcotic analgesic	4	4	2
Proton pump inhibitor/H2 receptor blocker	3	2	1
Antiemetic	1	1	1
Antiaggregant/anticoagulant	8	1	0
Electrolyte imbalance and pH drugs	8	–	1
Paracetamol/nonsteroidal anti-inflammatory drugs	40	7	2
Topical creams	8	–	1
N-acetyl cysteine/human albumin/B12/inhaler nebulizer	11	1	3
Adrenalin	2	1	1
Laxative	3	–	1
Antidepressants	6	1	–
Corticosteroid	3	2	1
Eye drop medications	6	–	1
Antihistamine	2	1	1
Atropin	1	–	1
Antihypertensive	5	1	–
Local anesthetic	2	–	1
Diazomide/dopamine/protamine sulfate/diazepam	4	–	1
Anesthetic sedatives	–	10	–
Rhogam	1	–	–

Table 4. Hospitalization, operating room and emergency consumables

Consumables	Hospitalization	Operating room	Emergency department
Injectors	64	65	72
Diaper	16	–	2
Infusion pump/dose flow	30	13	4
Urine catheter and bag/cathejel	30	11	32
Urofix hourly urine meter	12	–	–
Intracet and 3-way faucet	26	14	28
Vein valve	10	–	1
Plasters and dressings	16	62	8
Nebul and oxygen mask	19	1	21
Aspiration catheter	13	54	17
Distilled water	8	–	21
Oral care set	5	1	–
Enteral feeding set and foods	11	–	–
Vomit bag	4	–	3
T connector	5	–	–
Edit extension hose	11	40	–
Electrocardiography electrode	2	17	8
Suture material and stapler	2	58	9
Central venous catheter	3	5	7
Glove (sterile/nonsterile)	183	151	306
Active and moisture-retaining bacteria filter	1	10	–
Cautery	–	24	–
Chest tube set	2	–	–
Polyglactin	–	46	–
Airway	–	9	–
Endotracheal tube	–	17	–
Skin marking pen	–	5	–
Hemovac drain	–	1	–

Table 5. Hospitalization, operating room and emergency fluids

Fluids	Hospitalization	Operating room	Emergency department
Isotonics (100/150/250/500/1000 mL)	83	23	43
Dextrose (100/150/250/500/1000 mL)	41	4	11
3% Hypertonic sodium chloride	4	–	–
1/3 Isodex solution	4	–	5
Polgyl perfusion solution	3	–	–
Ringer lactate (500/1000 mL)	5	2	7
Irrigation/Polyflex solutions	2	3	19

results all over the world. The most important factor in this is the results of people from the event and the difference in the frequency of the occurrence of earthquakes. This is due to the fact that approximately 16,000 people died in the East Marmara (Gölcük) earthquake with a magnitude of 7.4 in 1999, while a few people died in the first two earthquakes with a magnitude of 7.6 and 8 in 2003, and only one person in the second, as a result of a heart attack.[10] Another import-

ant point is that human-induced disasters are also added to the disasters that occur today.[1]

The earthquake can sometimes affect a very wide geographical area, and the number of casualties and injuries can be very high. For this reason, disaster area triage should be applied. Level 1 (disaster area triage): This level determines the treatment and hospitalization of injured and severely injured people in or outside the disaster area. Level 2 (Medical triage): It is the determination of the level of medical treatment of the injured by experienced medical personnel. Level 3 (Evacuation triage): Primarily sending the injured to centers where medical treatment will be applied.[11–13] This triage method was also used in the study.

Since the emergency health service is very important in the earthquake area, it is necessary to talk about this issue in general terms. Emergency and accident centers constitute one of the most important units of the emergency health chain. This chain starts with emergency aid and rescue and continues with transport, emergency, and accident centers and rehabilitation services. The system is complicated and all the links of the chain are intertwined like a spinning wheel. A defect or failure in the links of the chain also affects all other links. The duty of each element in this chain is to provide attentive and correct medical care and treatment to the injured person or emergency patient. This situation reduces the degree of death and disability.[14] The point to be noted here is that every hospital should have an emergency disaster preparedness plan and it should be regularly renewed in accordance with the conditions of the day. In addition, hospitals should have emergency evacuation plans in case they are affected by an earthquake or another disaster.[15]

Emergency health services in the world are generally based on one of two models. Some countries that implement the Anglo-American Model are America, England, Canada, and Turkey. Some countries that implement the Franco-German Model are Germany, France, Greece, and Russia. In the Anglo-American Model, patient care is less in the field and transport to the hospital for treatment which is high. In addition, those who provide care in the disaster area are usually paramedics. The main purpose is to take the patient to the hospital as soon as possible. Transport location is emergency departments.[16] The Anglo-American model was used in the study.

When the hospitalizations were examined in the Eastern Marmara earthquake, 147 of the 330 injured were admitted to the orthopedics and traumatology clinic and ranked first. Other patients were hospitalized in general surgery, plastic surgery, and thoracic and cardiovascular surgery services.[17] It was observed that the majority of the patients hospitalized in Kartal Training and Research Hospital after the Marmara earthquake were hospitalized in the orthopedics and traumatology service, 96 of the 160 operations were performed for orthopedic reasons, while the other operations were laparotomy, tube thoracostomy, and head and facial bone fixation.[18] Orthopedic injuries were prominent in 234 (51%) of the Gujarat earthquakes in India.[19] In the Van earthquake, most of the cases were related to orthopedics and traumatology.[20] In our study, 15 of 35 hospitalized patients were orthopedic patients, which was consistent with similar studies. The incidence of crush syndrome varies between 2 and 15% in injured people who are buried and rescued after an earthquake. Renal failure occurs in approximately half of these patients. Therefore, the importance of dialysis centers comes to the fore in the earthquake zone.[21] Crash syndrome was seen in six cases in the study. However, as a result of the medical treatment given, kidney failure did not develop.

Emergency services and inpatient services are the most important units of the health chain in the earthquake zone. This chain starts with emergency aid and rescue and continues with transport, emergency, and accident services and rehabilitation services. Işık et al.,[22] in their study, document the list of necessary medical consumables, fluids, and drugs to be used in earthquakes, including the scene, before and after the hospital. They also report the precautions to be taken with the crime scene and emergency service triage. Similarly, in the study, medical consumables, liquids, and drugs are listed in Tables 3–5.

One of the important results of the study was the high number of patients waiting for support in the first 6 h, the rate of hospitalization, and intensive care requirement. The fact that such an analysis has not been carried out in higher and lower scale earthquakes leaves the question of whether there will be people waiting for support in the first 6 h unanswered. The other result is the removal of the details of the medical material, fluid, and drug used.

The most important factor limiting the study is that analyses other than the first 24 h were not used.

Conclusion

Despite the level of knowledge and technology that human beings have come to, they do not have any effect on the formations that cause natural disasters. The most effective and only action that can be taken against an earthquake today and in the future is to conduct research, develop various plans, and put them into practice to minimize its effects on society. For the golden hours after the earthquake, the first medical intervention and the health service applied after it should be continuously improved. In this way, health care will be provided faster and with better quality in disasters, and every experience will be the salvation of a life.

Ethics Committee Approval: This study was approved by the Bakırköy Dr. Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (Date: 01.02.2021, Decision No: 2021-03-26).

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ORİJİNAL ÇALIŞMA - *ÖZ*

Depremlerin ilk 24 saatinde afet bölgesi triyajı, hastane öncesi ve hastane prosedürlerinin değerlendirilmesi: 6.6 Elazığ depremi

Dr. Şükrü Yorulmaz,[1] Dr. Semih Korkut,[2] Dr. Figen Tunalı Türkdoğan,[3] Dr. Kenan Ahmet Türkdoğan[2]

[1]Sağlık Bakanlığı, Acil Sağlık Hizmetleri Genel Müdürlüğü, Ankara
[2]Sağlık Bilimleri Üniversitesi, Çam ve Sakura Şehir Hastanesi, Acil Tıp Kliniği, İstanbul
[3]İstanbul Fizik Tedavi ve Rehabilitasyon Eğitim ve Araştırma Hastanesi, Radyoloji Kliniği, İstanbul

AMAÇ: Depremler doğal olaylardır ancak sebep oldukları tahribat oldukça fazladır. Bir depremi önlemek mümkün olmadığı için deprem konusunda bilinçli ve duyarlı bireyler yetiştirmek ve çözüm aramak gerekir. 2020 Elazığ depreminde kullanılan triyaj, sarf malzemeleri, sıvılar ve ilaçların sunulması amaçlandı.

GEREÇ VE YÖNTEM: 24 Ocak 2020 tarihinde merkez üssü Sivrice/Elazığ olan depremden sonra, etkilenen tüm mağdurlar, hastane öncesi triyaj durumu, hastanede yatış sırasında acil durum ve diğer yatan hasta hizmetlerinin yönetimi, ameliyatlar dahil tıbbi müdahaleler, sarf malzemeleri, sıvılar ve ilaçlar ilk 24 saatteki verilerle geriye dönük olarak değerlendirildi.

BULGULAR: Elazığ'da rihter ölçeğine göre 6.6 büyüklüğünde ve 22 saniye süren depremin ardından toplam yaralı sayısı 974 oldu. Otuz yedi (%3.7) kişi hayatını kaybederken, 18'i (%1.8) kadındı. Enkazda 34, acil serviste üç kişi hayatını kaybederken, yaş ortalamaları 46.0±12.5 yıl idi. İlk 24 saatte 654 hasta kayıt altına alınırken, bunlardan 30'u 112 Komuta Kontrol Merkezi'nde, 624'ü ayakta tedavi gördü. Üç yüz yirmi kişiye kimlik bilgileri olmadığı için geçici kayıt yaptırıldı.

TARTIŞMA: Deprem öncesi hazırlıklı ve organize olmak ve erken müdahale etmek afetzedelerin hayatta kalmasında önemli başarı sağlayacaktır.

Anahtar sözcükler: 112 Komuta Kontrol Merkezi; deprem; Elazığ; tıbbi destek; triaj.

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