Evaluation of Deaths in Malatya Due to the Earthquake Centered in Kahramanmaras on 6 February 2023

6 Şubat 2023'te Kahramanmaraş Merkezli Depremlerde Malatya'da Meydana Gelen Ölüm Olgularının Değerlendirilmesi

 Mucahit ORUC[1], Mehmet Efdal SAYDAN[1], Emre BOZ[2], Abdulkerim YAYLA[1], Erkal GUMUSBOGA[1], Mesut YILMAZ[1], Osman CELBIS[3]

[1]Inonu University Faculty of Medicine, Department of Forensic Medicine, Malatya, Türkiye

[2]Council of Forensic Medicine, Istanbul, Türkiye

[3]Alanya Alaaddin Keykubat University Faculty of Medicine, Department of Forensic Medicine, Antalya, Türkiye

ABSTRACT

Objective: This study aimed to retrospectively examine the cases of individuals who lost their lives as a result of the Kahramanmaraş earthquakes on February 6, 2023, and were brought to the study area designated by the Malatya Forensic Medicine Group Presidency.

Methods: A total of 916 cases were referred for identification to the center designated as the study area by the Malatya Forensic Medicine Group Presidency following the earthquakes on February 6, 2023, and were examined retrospectively. The obtained data were coded and entered into IBM SPSS Version 22. Descriptive statistics and frequency tables were generated, and the data were analyzed.

Results: Among the 916 cases included in the study, 477 (52.1%) were male and 439 (47.9%) were female; 23.2% were under the age of 18, and 13.8% were over the age of 65. The majority (87.9%) were citizens of the Republic of Türkiye. Most injuries were localized to the head and neck region (37.5%). Body integrity was preserved in 88.3% of cases, and signs of decomposition were observed in 77.1%. Fast Technology for the Analysis of Nucleic Acids blood samples was obtained in 39.5% of cases. All bodies were identified through a combination of primary and secondary identification methods and subsequently delivered to their relatives.

Conclusions: In countries facing major disaster risks, forensic medicine units must always be prepared for such events. Postmortem examination and victim identification are multidisciplinary processes that require the coordinated efforts of experts from various fields.

Keywords: Earthquake, postmortem examination, identification

ÖZ

Amaç: Bu çalışmada 06.02.2023 tarihinde Kahramanmaraş depremleri sonucu hayatını kaybeden ve Malatya Adli Tıp Grup Başkanlığı tarafından belirlenen çalışma alanına getirilen olguların retrospektif olarak incelenmesi amaçlanmıştır.

Yöntemler: Çalışmamızda 6 Şubat 2023 tarihinde meydana gelen depremler sonucu Malatya Adli Tıp Grup Başkanlığı tarafından çalışma alanı olarak belirlenen merkeze kimlik tespiti amacıyla getirilen 916 olgu retrospektif olarak incelenmiştir. Elde edilen veriler kodlanarak IBM SPSS Version 22 programına girilmiştir. Verilerin tanımlayıcı istatistikleri ve frekans tabloları oluşturularak veriler analiz edilmiştir.

Bulgular: Çalışmamıza dahil edilen 916 olgunun 477'si (%52,1) erkek, 439'u (%47,9) kadın, %23,2'si 18 yaş altı, %13,8'i 65 yaş üstü, %87,9'u Türkiye Cumhuriyeti vatandaşı, olguların çoğunluğu baş-boyun bölgesinden yaralanmış (%37,5), %88,3'ü vücut bütünlüğünü korumuş, %77,1'inde ayrışma belirtileri var, %39,5'inden nükleik asitlerin analizi için Hızlı Teknoloji kartları-kan örnekleri alınmış ve tüm cesetler birincil ve ikincil kimliklendirme yöntemlerinin bir kombinasyonu kullanılarak yakınlarına teslim edilmiştir.

Sonuçlar: Büyük afet riskleriyle karşı karşıya olan ülkemizde, adli tıp birimleri her zaman afetlere hazır olmalıdır. Ceset muayenesi ve kimliklendirme, farklı alanlardaki birçok uzmanın koordineli çalışmasını gerektiren multidisipliner süreçlerdir.

Anahtar kelimeler: Deprem, ölü muayenesi, kimliklendirme

INTRODUCTION

Disaster is defined as a natural, technological, or human-induced event and its consequences which cause physical, economic, and social losses for the entire society or specific segments of it. Such events disrupt or halt normal life and human activities and exceed the capacity of the affected community to cope[1].

Disaster management is a comprehensive management approach that requires the mobilization of all institutions, organizations, and societal resources toward a common purpose. It involves planning and implementing activities in the phases of mitigation, preparedness, response, and recovery, to prevent disasters and reduce their impact[2]. This approach encompasses technical, administrative, and legal measures to be undertaken before, during, and after a disaster. It ensures effective implementation during disasters and facilitates improvements to the system based on lessons learned from past events[3].

Following disasters that result in mass casualties, states have a duty to assess the scale of the disaster and ensure that the deceased are returned to their families. Historical experiences have demonstrated the necessity of establishing standardized procedures for victim identification[4].

One of the greatest challenges in disasters is the identification of the deceased. Identification refers to the process of determining an individual's identity by assessing characteristics. This process carries legal, sociological, humanitarian, and religious significance. Given these dimensions and the complexity of disaster settings, identification must be standardized, scientifically grounded, evidence-based, literature-supported, reliable, and feasible under field conditions[5].

A proper identification process requires the collection and correlation of antemortem and postmortem data. Antemortem data include an individual's physical characteristics, clothing, jewelry, personal belongings, and medical or dental records. Postmortem data are derived from external and internal examinations, autopsies, and laboratory analyses. Frequently used identification methods include external and internal examination findings, dental records, fingerprint data, DNA profiles, and visual recognition[6].

The Disaster Victim Identification Protocol, developed by Interpol, provides international guidelines for the identification of disaster victims. Within this framework, disasters are classified as open, closed, or hybrid based on the nature of antemortem and postmortem data available[7]. In Türkiye, the Türkiye Disaster Response Plan outlines the roles and responsibilities of coordination units and working groups in disaster response. It sets forth the fundamental principles of planning and implementation before, during, and after disaster events. Within this scope, the duties of the disaster identification and burial working group include identifying the deceased, recording and tracking bodies, forwarding death reports to the relevant authorities, and designating temporary morgue and mass grave sites to prevent decomposition[8].

On February 6, 2023, two major earthquakes struck southeastern Türkiye, affecting 11 provinces and resulting in 53,537 deaths[9]. In this study, we aimed to examine the precautions for identification processes to be taken before disasters, as well as the procedures required during and after disasters. For this purpose, we evaluated data from the Kahramanmaraş-centered earthquake of February 6, 2023, in Malatya City, including age groups, sex, nationality, timing of post-earthquake examinations, trauma localization, body integrity, late signs of death, and biological samples collected for forensic analysis.

MATERIALS and METHODS

Ethics Committee Approval:

Ethics committee approval for this study was obtained from the Inonu University Scientific Research and Publication Ethics Committee (Health Sciences Non-Interventional Clinical Research Ethics Committee) (decision no: 2023/4929, date: 26.12.2023).

This retrospective study included 916 cases that died in the Kahramanmaraş-centered earthquakes on February 6, 2023, and were referred to the designated working area of the Malatya Forensic Medicine Institute for postmortem examination, identification, and burial authorization. Based on the approval letter of the Forensic Medicine Institute (dated 20.09.2023, No: 2023/893), data were obtained from the Malatya Forensic Medicine Group Presidency Morgue Specialization Department. Sources included photographs of the deceased, postmortem examination forms, burial permits, and DNA reports of cases not identified through secondary methods.

Since the study was conducted on autopsied cadavers, informed consent was not required. All procedures were performed in accordance with ethical standards and the principles of the Declaration of Helsinki.

When evaluating trauma localization, each injury in cases with multiple affected regions was assessed separately. For genetic analysis, if more than one sample had been collected from the same case, each sample was evaluated individually Age classification was based on the Turkish Statistical Institute: 1-18 years (children), 18-65 years (adults), and ≥65 years (elderly)[10-12]. Nationality was determined by the presence of a Turkish Republic identity number, foreign identity number, or passport number, as recorded in death examination forms and burial permits.

Cases with insufficient data due to incomplete forms, missing information, or non-standard photographs were excluded from the study. Photographs taken during postmortem examinations were used to evaluate injury localization. As limitations, some injuries not directly contributing to death may not have been detected, and possible errors in assessing body integrity and putrefaction status were acknowledged.

Statistical Analysis:

All data were coded and entered into IBM SPSS Statistics Version 22. Descriptive statistics and frequency tables were generated. Inferential statistics were not used.
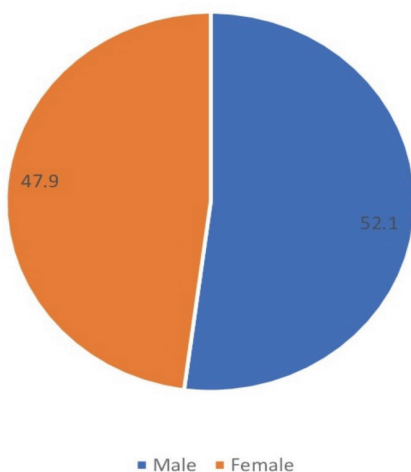
RESULTS

Of the 916 earthquake-related fatalities, referred to the study area designated by the Malatya Forensic Medicine Group Presidency, following the Kahramanmaraş-centered earthquakes on February 6, 2023, 477 (52.1%) were male and 439 (47.9%) were female (Figure 1).

Age distribution analysis revealed that 23.2% (n=213) of the cases were children (<18 years), 62.8% (n=576) were adults (18-65 years), and 13.8% (n=127) were elderly (>65 years) (Table 1). The majority of victims (87.9%, n=805) were citizens of the Republic of Türkiye, while 12.1% (n=111) were foreign nationals (Table 2).

The distribution of postmortem examinations by day is presented in Figure 2. On the day of the earthquake (06.02.2023), examinations were conducted on 152 cases.

A further 82 cases were examined on the second day (07.02.2023), 171 cases on the third day, and 200 cases on the fourth day. No documentation regarding the examination date was available for 11 cases (Figure 2). Among Turkish citizens, 139 examinations were performed on the first day, 77 on the second day, 149 on the third day, and 188 on the fourth day, with the numbers fluctuating thereafter. Among foreign nationals, 13 were examined on the first day; 5 on the second; 22 on the third; and 12 on the fourth day (Table 3).

Examination of photographs, death reports, and burial permits demonstrated that the head and neck region was the most frequently affected site of injury (n=731). Thoracic and abdominal injuries were the next most common. No evidence of trauma was detected in 30 cases, and injury localization could not be determined in 34 cases due to insufficient data (Table 4).

Table 1. Age groups of the cases.		
	n	%
<18 Years	213	23.25
18-65 Years	576	62.88
>65 Years	127	13.86
Total	916	100.0

Table 2. Nationality of the cases.		
	n	%
Citizen of the Republic of Turkiye	805	87.9
Foreign National	111	12,1
Total	916	100.0

Figure 1. Sex of people who died in the earthquake
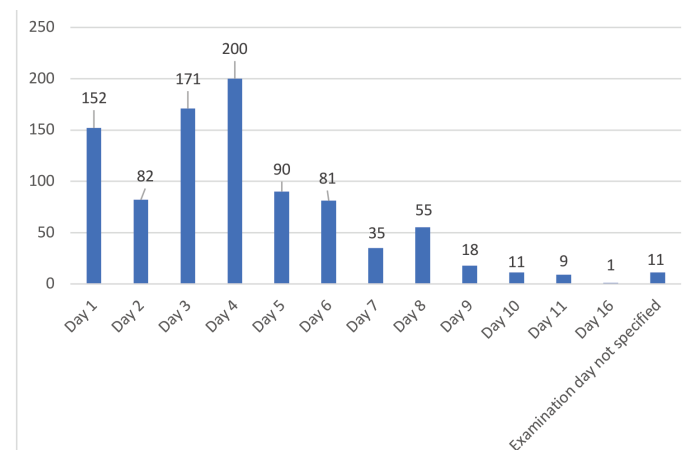
Figure 2. Examination Day/Number of Examinations

Table 3. Days on which postmortem examinations were conducted according to the nationality of the cases.				
		Citizen of the Republic of Turkiye	Foreign national	Total
Date of examination*	1. Day	139	13	152
	2. Day	77	5	82
	3. Day	149	22	171
	4. Day	188	12	200
	5. Day	67	23	90
	6. Day	74	7	81
	7. Day	27	8	35
	8. Day	46	9	55
	9. Day	12	6	18
	10. Day	9	2	11
	11. Day	9	0	9
	16. Day	1	0	1
	Eaxmination date not specified	7	4	11
Total		805	111	916

*The period from 06.02.2023, when the earthquake occurred, to 21.02.2023 was taken as basis

Table 4. Injury areas of the cases.		
	n	%
Head-neck	731	37.5%
Thorax	532	27.3%
Abdomen	291	14.9%
Lower extremity	159	8.1%
Upper extremity	139	7.1%
Vertebra	35	1.8%
Nontraumatic	30	1.5%
Undetermined with available data	34	1.7%

Table 5. Body integrity of the cases.		
	n	%
Preserved	809	88.3
Impaired	87	9.5
Undetermined with available data	20	2.2
Total	916	100,0

Table 6. Putrefaction findings of the cases.		
	n	%
Exist	706	77.1
Absent	188	20.5
Undetermined with available data	22	2.4
Total	916	100,0

Regarding body integrity, 88.3% (n=809) of the cases had preserved integrity, while 9.5% (n=87) demonstrated compromised integrity (Table 5). Signs of putrefaction were observed in 77.1% (n=706) of cases, while 20.5% (n=188) showed no evidence of putrefaction at the time of examination (Table 6).

Forensic sampling revealed that biological materials collected for potential genetic analysis included Fast Technology for the Analysis of Nucleic Acids (FTA) blood cards, oral swabs, hair roots, teeth, amputated tissue, and skin. The most frequently collected material was FTA blood samples (39%), followed by hair (35.5%), teeth (13.4%), and oral swabs (6.6%). More than one type of DNA sample was collected in several cases. In 42 cases, DNA sampling was documented, but the sample type was not specified, preventing further evaluation (Table 7).

In addition, fingerprint samples were obtained from all cases. While FTA blood cards were the most commonly used sampling method during the initial days following the earthquake, their use decreased over time, with hair and dental sampling becoming more prevalent in subsequent days (Table 8).

DISCUSSION

In this study, 52.1% of the earthquake-related fatalities examined at the Malatya Forensic Medicine Institute Branch Directorate following the Kahramanmaraş-centered earthquakes of February 6, 2023, were male, and 47.9% were female. These findings are consistent

with the 2022 Gender Statistics data published by the Turkish Statistical Institute[13].

The death examination and identification processes, which began on the day of the first earthquake (February 6, 2023), showed a relative decrease on the second day, but increased again on the third and fourth days. The first earthquake occurred at 04:17 and the second major earthquake at 13:24 on the same day[14]. We consider that the slowdown of the second day, followed by an acceleration on subsequent days, was due to the disruptive impact of the second destructive earthquake and the subsequent disorganization and reorganization of operational processes.

Regarding injury distribution, the most commonly affected region was the head and neck (37.5%), followed

by the thorax (27.3%) and abdomen (14.9%). In contrast, the literature frequently reports extremity and soft-tissue injuries as the most common earthquake-related trauma, while head, thoracic, and abdominal injuries are described less frequently[15-17]. We suggest that this discrepancy may be due to the relatively lower incidence, but higher lethality, of head, thoracic, and abdominal injuries[18,19]. It is also important to note that in tectonic disasters such as earthquakes, death may result not only from acute trauma but also from asphyxia, hypovolemia, hypothermia, hypoglycemia, or cardiac pathologies triggered by fear and panic[20,21]. We, therefore, consider that non-traumatic deaths in our series were more likely attributable to pre-existing chronic diseases, acute exacerbations, and environmental conditions rather than direct trauma.

Signs of putrefaction were identified in 77.1% of cases. The earthquakes occurred during severe winter conditions[22]. Although cold weather is generally expected to delay putrefactive changes[23], studies using thermal imaging have demonstrated that damaged or collapsed buildings retain and radiate thermal energy[24]. We believe that the retention of heat within collapsed structures contributed to accelerated decomposition processes despite the cold climate.

Forensic sampling for genetic identification included FTA blood cards, oral swabs, hair roots, teeth, amputated tissue, and skin. The most frequently collected samples were FTA blood cards (39.0%), followed by hair (35.5%), teeth (13.4%), and oral swabs (6.6%). During the initial days of the disaster, FTA blood cards were the preferred

Table 7. Samples taken from cases.

	n	%
FTA	378	39.0%
Oral swab	64	6.6%
Hair	344	35.5%
Tooth	130	13.4%
Bone	3	0.3%
Amputated limb	1	0.1%
Skin	6	0.6%
Unspecified sample	42	4.3%
Total*	957	100.0%

*More than one sampling method was used in some of the cases

FTA: Fast Technology for the Analysis of Nucleic Acids

Table 8. Samples taken and their numbers according to the date of examination.

		1. Day	2. Day	3. Day	4. Day	5. Day	6. Day	7. Day	8. Day	9. Day	10. Day	11. Day	16. Day	Examination date not specified	Total
Sample	FTA	111	69	74	69	28	14	0	1	7	0	1	0		378
	Oral swab	3	0	60	1	0	0	0	0	0	0	0	0		64
	Hair	32	7	29	133	66	39	12	10	8	1	1	0		344
	Tooth	2	0	1	1	2	31	25	43	8	8	7	1		130
	Bone	0	0	0	0	0	0	0	0	0	2	1	0		3
	Amputated limb	0	0	0	0	0	1	0	0	0	0	0	0		1
	Skin	1	3	0	0	2	0	0	0	0	0	0	0		6
	Unspecified sample	4	3	20	1	1	1	0	1	0	0	0	0	11	42
Total*		152	82	170	200	90	81	35	55	18	11	9	1		968

*Cases that cannot be evaluated are cases that were not recorded on the examination form even though DNA sampling was performed

FTA: Fast Technology for the Analysis of Nucleic Acids

sampling method. However, in subsequent days, their use declined, while hair and dental samples were collected more frequently. This shift was likely due to environmental conditions, bodies retrieved later were exposed to freezing temperatures, resulting in coagulated blood and making blood sampling technically challenging.

CONCLUSION

The identification methods employed in disaster settings vary according to the magnitude of the event, geographical and seasonal conditions, and socio-economic factors. The decisions made by forensic physicians in response to these conditions are therefore of critical importance. For instance, when seasonal factors reduce the reliability of a particular sampling method, alternative approaches must be applied.

DNA-based primary identification methods remain indispensable, particularly in cases where the body integrity is severely compromised and visual recognition is impossible. Although primary methods-especially DNA analysis- are considered the gold standard, in large-scale disasters, the reliance on secondary identification methods becomes increasingly significant. From both a time and cost perspective, the application of secondary methods in mass fatality incidents provides practical advantages by accelerating burial procedures, facilitating disaster management, and ensuring that future legal processes can proceed without interruption.

Ethics

Ethics Committee Approval: Ethics committee approval for this study was obtained from the Inonu University Scientific Research and Publication Ethics Committee (Health Sciences Non-Interventional Clinical Research Ethics Committee) (decision no: 2023/4929, date: 26.12.2023).

Informed Consent: This is a retrospective study.

Footnotes

Author Contributions

Concept: E.B., O.C., Design: M.O., E.G., O.C., Data Collection and/or Processing: E.B., A.Y., Analysis or Interpretation: E.G., M.Y., Literature Search: A.Y., M.Y., Writing: M.E.S.

Conflict of Interest: The authors have no conflict of interest to declare.

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