ORIGINAL RESEARCH ORİJİNAL ARAŞTIRMA

DOI: 10.5336/forensic.2025-112362

Sudden Natural Cardiac Deaths Related to Psychological and/or Physical Trauma of Unintentional Origin: Analytical-Cross Sectional Study

Ruhsal ve/veya Doğrudan Öldürücü Nitelikte Olmayan Fiziksel Travma ile İlişkili Doğal Kökenli Ani Kardiyak Ölümler: Analitik-Kesitsel Araştırma

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This study was prepared based on the findings of Kağan Gürpınar's thesis study titled "Sudden Natural Cardiac Deaths Related to Psychological and/or Physical Trauma of Unintentional Origin" (İstanbul: Council of Forensic Medicine; 2002).

ABSTRACT Objective: Sudden cardiac death is the leading cause of sudden and unexpected death in adults, most commonly caused by coronary artery disease. This study aims to evaluate natural-origin sudden cardiac deaths that occurred following psychological and/or non-fatal physical trauma, in order to understand their characteristics and contributing factors. **Material and Methods:** The study analyzed 250 cases of sudden cardiac death related to psychological or non-fatal physical trauma, selected from 10,750 death cases referred to the 1st Specialization Board of the Forensic Medicine Institute under the Ministry of Justice of Türkiye. The cases span a 5-year period between 1997-2001. Data were obtained from case files, including autopsy reports, medical histories, and incident details. **Results:** The average age was 51.3±17.3 years, with 86% of cases being male. The highest rate of sudden cardiac death occurred in the 60-69 age group (22.8%). In 70% of the cases, death happened within the first hour after the traumatic event. Autopsies were performed in 95.2% of cases, but 20.1% were conducted by physicians who were not forensic specialists. **Conclusion:** To clarify the relationship between trauma and sudden cardiac death, it is crucial to determine the cause of death accurately. This requires comprehensive forensic autopsies in accordance with standard protocols, along with full contextual information including incident details, witness statements, available visuals, and medical history. Macroscopic and histopathological analyses confirm coronary artery disease as the leading cause of death, in line with the general literature.

Keywords: Sudden cardiac death; trauma; forensic medicine

ÖZET Amaç: Ani kardiyak ölüm, erişkinlerde ani ve beklenmeyen ölümlerin en sık görülen nedenidir ve genellikle koroner arter hastalığına bağlıdır. Bu çalışmanın amacı, psikolojik ve/veya ölümcül olmayan fiziksel travma sonrası meydana gelen doğal kökenli ani kardiyak ölüm olgularını inceleyerek bu ölümlerin özelliklerini ve katkıda bulunan faktörleri değerlendirmektir. **Gereç ve Yöntemler:** Çalışmada, Adalet Bakanlığına bağlı Adli Tıp Kurumu 1. İhtisas Kuruluna 1997-2001 yılları arasında sevk edilen 10.750 ölüm olgusu arasından, psikolojik veya ölümcül olmayan fiziksel travmayla ilişkili 250 ani kardiyak ölüm olgusu analiz edilmiştir. Veriler; olgu dosyalarından, otopsi raporlarından, tıbbi geçmişlerden ve olayın detaylarından elde edilmiştir. **Bulgular:** Olguların ortalama yaşı 51,3±17,3 yıl olup, %86'sı erkekti. En yüksek ölüm oranı %22,8 ile 60-69 yaş grubunda görüldü. Olguların %70'inde ölüm, travmatik olayı takip eden ilk saat içinde gerçekleşmiştir. Olguların %95,2'sine otopsi yapılmış, ancak bu otopsilerin %20,1'i adli tıp uzmanı olmayan hekimlerce gerçekleştirilmiştir. **Sonuç:** Travma ile ani kardiyak ölüm arasındaki ilişkinin netleştirilebilmesi için ölüm nedeninin doğru şekilde belirlenmesi gerekir. Bu da yalnızca standartlara uygun olarak yapılan ayrıntılı adli otopsilerle mümkündür. Ayrıca olayın koşulları, tanık ifadeleri, varsa görsel kayıtlar ve kişinin tıbbi geçmişi gibi bağlamsal bilgiler değerlendirmeye dâhil edilmelidir. Makroskobik ve histopatolojik incelemeler, koroner arter hastalığının ölümlerin başlıca nedeni olduğunu ortaya koymuştur ve bu sonuç literatürle uyumludur.

Anahtar Kelimeler: Ani kardiyak ölüm; travma; adli tıp

TO CITE THIS ARTICLE:
Gürpınar K, İnanıcı MA. Sudden natural cardiac deaths related to psychological and/or physical trauma of unintentional origin: Analytical-cross sectional study. Turkiye Klinikleri J Foren Sci Leg Med. 2026;23(1):25-33.

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Peer review under responsibility of Turkiye Klinikleri Journal of Forensic Medicine and Forensic Sciences.

Received: 29 May 2025 ***Received in revised form:*** 11 Jul 2025 ***Accepted:*** 14 Jul 2025 ***Available online:*** 15 Sep 2025

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The sudden death of a person who appears healthy, without any apparent cause, is classified as sudden death.[1] According to the World Health Organization, sudden deaths are defined as deaths occurring within 24 hours of the onset of symptoms. In most of these cases, death occurs within minutes or even seconds after symptoms first appear.[2-6]

When a patient, their relatives, friends, or doctor are unaware of an underlying disease and death occurs due to this unknown condition, it is classified as unexpected death.[6,7] Among sudden and unexpected deaths in adults, cardiac-related conditions are the most common cause, with coronary artery disease, especially due to atherosclerosis ranking first among these conditions (Figure 1).[8-17]

In individuals with heart disease, whether diagnosed or clinically undetected, any form of trauma-whether psychological or non-fatal physical-can disrupt the stable state of the disease, making symptoms more apparent or triggering an irreversible process leading to sudden cardiac death. Such deaths are frequently encountered in forensic medicine and represent a significant issue. The critical question in these cases is whether the individual died solely due to trauma, solely due to their pre-existing disease, or as a result of the combined effects of both. This question arises not only in cases of sudden cardiac death but also in deaths resulting from aneurysmal hemorrhages and pulmonary embolism. Other considerations include whether there was a contributing factor beyond the injury itself and whether specific articles of the Turkish Penal Code apply. Some articles outline special conditions that may reduce sentences in homicide-related offenses, and sudden cardiac deaths where trauma is established as a contributing factor fall within this scope.

Determining the nature of the trauma and considering the timeframe in which it caused fatal consequences are crucial for establishing the causal relationship between the triggering event and death, forming the forensic-medical aspect of such cases.[18,*,**]

In this study, psychological trauma refers to factors causing psychic stress (such as fear, helplessness, or feelings of violence) or conditions affecting the autonomic nervous system, leading to biochemical and physiological changes in the individual. Non-fatal physical trauma, on the other hand, refers to any injury classified under effective action in the Turkish Penal Code that does not pose a direct life-threatening risk, as well as any other type of physical trauma affecting bodily integrity, even if not covered under this legal definition. The study examines the relationship between these types of trauma and death.

Considering the importance of accurately establishing the causal link between trauma and sudden cardiac deaths-one of the most common natural sudden deaths encountered in forensic medicine-this study aims to contribute to the evaluation of such cases. It emphasizes the necessity of integrating crime scene investigations, available visual evidence, and witness and suspect testimonies with standard autopsy procedures and forensic psychiatry criteria to ensure comprehensive and consistent forensic assessments.

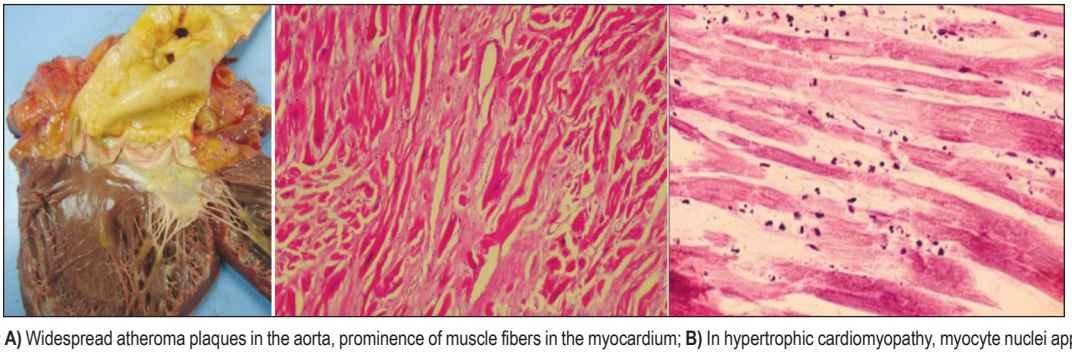


FIGURE 1: A) Widespread atheroma plaques in the aorta, prominence of muscle fibers in the myocardium; **B)** In hypertrophic cardiomyopathy, myocyte nuclei appear large, hyperchromatic and irregular, with interstitial fibrosis (hematoxylin-eosin, x200); **C)** Extensive necrosis of the myocardium (hematoxylin-eosin, x400)

** Sözen Ş. Stres ve/veya doğrudan öldürücü olmayan müessir fiile bağlı akut kalp hastalığı sonucu oluşan ölümlerin adli tıptaki yeri [Uzmanlık tezi]. İstanbul: Adli Tıp Kurumu; 1990.*
***Karadeniz Z. Kalp-damar hastalıklarına bağlı ölümlerin adli-tıbbi yönden değerlendirilmesi ve bu ölümlerde TCK'nin 451. ve 452/2. maddelerinin uygulama alanları [Uzmanlık tezi]. İstanbul: Adli Tıp Kurumu; 1990.*

MATERIAL AND METHODS

This study was reviewed and approved on December 2, 2002 by the Thesis Approval Board, which functions as the Ethics Committee of the Council of Forensic Medicine. This research was conducted in accordance with the Declaration of Helsinki.

This study retrospectively examined 250 cases of natural sudden cardiac death associated with psychological and/or non-fatal physical trauma from a total of 10,750 death cases referred by the courts to the 1st Specialization Board of the Forensic Medicine Institute under the Ministry of Justice of the Republic of Türkiye over a 5-year period between 1997-2001.

In this study, the 250 cases were analyzed based on their distribution by year, age and gender distribution, nature of trauma, and the specific inquiries made by the courts. Additionally, the relationship between gender and body or heart weight was examined, along with the monthly distribution of incidents. The time between the event and the onset of symptoms, as well as the time to death, were also considered. Other factors assessed included the presence of pre-existing medical conditions, the place of death, and findings that confirmed or suggested an underlying disease. Furthermore, the study reviewed the location where autopsies were performed, the medical professionals conducting them, and their yearly distribution. The macroscopic and microscopic cardiac pathologies observed during autopsies were also documented, alongside blood ethanol levels. The causes of death, as stated in postmortem examination and autopsy reports, were evaluated, with particular focus on establishing the causal relationship between trauma and death. The findings were discussed in comparison with existing literature.

Statistical analysis was conducted using the Epi Info 2000 software [Centers for Disease Control and Prevention (CDC), Atlanta/GA, USA], applying the chi-square test, with a significance level set at $p<0.05$.

RESULTS

Among the 250 cases included in this study, 215 (86%) were male, while 35 (14%) were female.

The age distribution of the cases ranged from 13 to 85 years, with an average age of 51.3±17.3 years. It was observed that 22.8% of the cases were in the 60-69 age group, while 6.4% belonged to the 10-19 age group. Among the 16 cases aged 10-19 years, 1 was 13 years old, 6 were 14 years old, 1 was 15 years old, 6 were 16 years old, 1 was 17 years old, and the last case was 18 years old.

The distribution of cases by age and gender is presented in Figure 2.

The relationship between gender, body weight, and heart weight is presented in Table 1 and Figure 3. No significant difference in heart weight was observed among different age groups ($p>0.05$).

Heart weight measurements were available for 159 (63.6%) cases, with the lowest recorded value being 220 g and the highest recorded value being 950 g. The average heart weight was found to be 427±125 g. Table 1 presents the mean heart weight values for cases with known body weight.

In this study, cases were classified based on the nature of the incident into sudden cardiac deaths due to psychological trauma, physical trauma, or a combination of both. Physical trauma alone refers to any type of physical impact that causes sudden death without inducing psychological trauma, such as a sudden and severe kick to the abdomen during playful interaction or the application of an electric current after needle insertion during acupuncture treatment.

This study demonstrated that 211 (84.4%) cases involved both psychological and physical trauma.

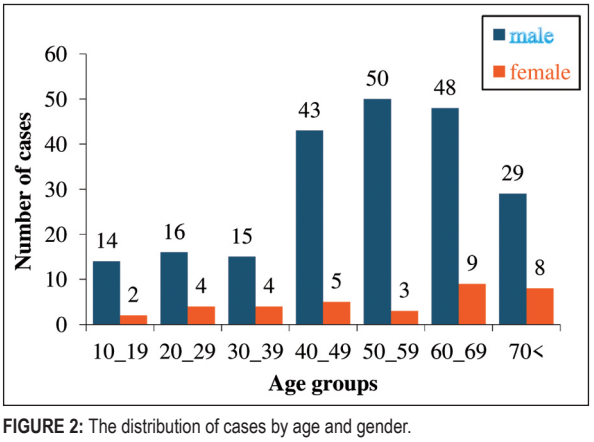


FIGURE 2: The distribution of cases by age and gender.

TABLE 1: The relationship between gender, body, and heart weights of cases*

	Male		Female		Total	
Body weight	Average heart weight	SD	Average heart weight	SD	Average heart weight	SD
50-54	435	±91	260		376	±120
55-59	375	±176	290	±14	332	±113
60-64	371	±50	300		362	±53
65-69	340	±96	435	±49	353	±95
70-74	447	±146	295	±21	423	±145
75-79	429	±112	400		426	±107
80≤	454	±79	350		448	±80
Total	408	±106	331	±65	397	±104

*Epi Info 2000 chi-square test (p>0.05); SD: Standard deviation

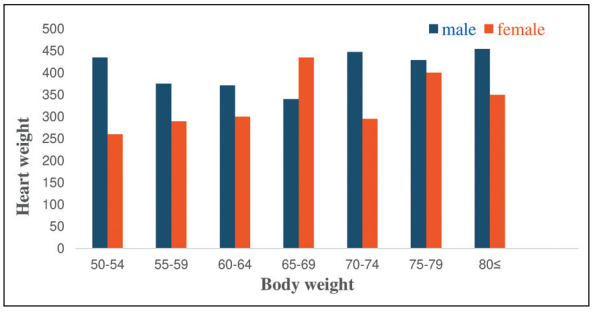


FIGURE 3: The relationship between gender, body, and heart weights of cases.*
*Epi Info 2000 chi-square test (p>0.05)

TABLE 2: Post-incident survival time of cases*

Survival time	n	%
Immediately after the incident	21	8.4
Within the first hour after the incident	154	61.6
Between 1-3 hours	18	7.2
Between 4-6 hours	11	4.4
Between 7-12 hours	10	4
Between 13-24 hours	36	14.4
Total	250	100.0

*Epi Info 2000 chi-square test (p>0.05)

TABLE 3: Distribution of pre-existing diseases

Previous illness	n	%
Heart disease	64	25.6
Hypertension	13	5.2
Diabetes	6	2.4
Other illnesses	19	7.6

Among the remaining 39 cases, 30 (12%) were attributed solely to psychological trauma, while 9 (3.6%) cases were linked only to physical trauma.

Symptoms were observed at the time of the incident or immediately afterward in 78 cases, while they began within the first hour following the event in 192 cases. It was determined that 175 (70%) cases died within the first hour after the event. The post-incident survival times of the cases are presented in Table 2. No significant relationship was found between age and survival time (r=-0.04, p>0.05).

Among the 250 cases included in the study, 84 (33.6%) cases had a known pre-existing disease before death, while 2 (0.8%) cases were confirmed to have no known pre-existing disease. However, in the remaining 164 (65.6%) cases, no data regarding prior illnesses were available.

It was observed that 64 (25.6%) cases had a previously diagnosed heart disease. While some cases had multiple pre-existing conditions, the majority were reported to have a single disease. The distribution of pre-existing conditions is presented in Table 3.

In the distribution of known heart diseases among the cases, 22 (8.8%) cases were reported to have a heart condition, although the specific disease was not mentioned. Among the specified heart diseases, coronary artery disease was the most common, found in 28 (11.2%) cases. This was followed by heart failure in 6 (2.4%) cases and valvular heart diseases in 4 (1.6%) cases. Additionally, one case each was reported to have tetralogy of Fallot, cardiomyopathy, and ventricular septal defect. One case pre-

sented with both coronary artery disease and heart failure.

Among the 54 (21.6%) cases who died in healthcare facilities, all received medical treatment. However, the details of the treatments were not specified in most cases. Symptoms suggestive of heart disease-such as chest pain, abdominal pain, cold sweating, shortness of breath, palpitations, electrocardiography findings, sudden shock and arrest during observation, shock syndrome, coma, or cardiac arrest-were noted in several cases.

For all 250 cases included in the study, forensic death examination reports were completed. Autopsies were performed in 238 (95.2%) cases, while 12 (4.8%) cases did not undergo autopsy. Among the autopsied cases, 187 were performed by forensic medicine specialists, 2 by pathology specialists, and 45 by other physicians. In 4 cases, the type of physician performing the autopsy was not specified.

Left ventricular wall thickness was measured in 105 (42%) cases, with values ranging from 0.8 cm to 4.0 cm. The average left ventricular wall thickness was 1.83±0.55 cm.

The distribution of macroscopic heart pathologies identified in autopsied cases is presented in Table 4. Some cases exhibited multiple simultaneous pathologies. Among the cases, 27 (10.8%) showed valvular pathology, 145 (58%) had varying degrees of coronary artery disease, and 115 (46%) cases exhibited old and/or new infarct areas in myocardial tissue.

In 177 (70.8%) cases, heart tissue samples were taken for histopathological examination. The distribution of histopathological diagnoses in these cases is presented in Table 5. Among these cases, 170 (68%) had a pathological diagnosis, while 7 (2.8%) cases showed no pathology. Some cases exhibited multiple coexisting pathologies. Coronary artery disease was identified in 39 (15.6%) cases. Myocardial hypertrophy was detected in 95 (38%) cases. Old and/or new infarct areas, along with focal and diffuse interstitial fibrosis in myocardial tissue, were observed in 107 (42.8%) cases.

Chronic passive hyperemia, edema, and congestion findings were detected in the lungs of 122

TABLE 4: Distribution of macroscopic heart pathologies observed in autopsy

Macroscopic pathology detected in the heart		n	%
Valvular disease	No pathology detected	32	12.8
	Pathology detected	27	10.8
	Total	59	23.6
Coronary artery disease	No pathology detected	28	11.2
	Mildly obstructed	12	4.8
	Moderately obstructed	32	12.8
	Severely obstructed	65	26.0
	Completely obstructed	31	12.4
	Coronary thrombosis	5	2.0
	Total	173	69.2
Myocardial sections	No pathology detected	46	18.4
	Hyperemia	19	7.6
	Old infarct scar	82	32.8
	Fresh infarct area	14	5.6
	Old and new infarct areas	19	7.6
	Hemorrhage	2	0.8
	Total	182	72.8
Other findings	Pericardial fat accumulation	5	2.0
	Myocardial wall aneurysm	8	3.2
	Ruptured aneurysm in the aorta	5	2.0
	Pallor	6	2.4
	Hemorrhage	2	0.8
	Aneurysm rupture	2	0.8
	Total	28	11.2

TABLE 5: Distribution of histopathological diagnoses related to the heart

Histopathological diagnosis related to the heart		n	%
Histopathology result	No pathology detected	7	2.8
	Pathology detected	170	68.0
	Total	177	70.8
Coronary artery disease	No pathology detected	2	0.8
	Mildly obstructed	2	0.8
	Moderately obstructed	9	3.6
	Severely obstructed	25	10.0
	Completely obstructed	1	0.4
	Rupture	2	0.8
	Total	41	16.4
Myocardial hypertrophy	Not detected	1	0.4
	Detected	95	38.0
	Total	96	38.4
Other myocardial findings	Not detected	2	0.8
	Old infarct scar	67	26.8
	Recent infarct area	6	2.4
	Old and recent infarct areas	11	4.4
	Focal fibrosis	1	0.4
	Diffuse interstitial fibrosis	22	8.8
	Total	109	43.6
Other findings	Hyperemia and/or congestion	7	2.8
	Recent hemorrhage	2	0.8
	Findings of heart failure	5	2.0
	Autolysis	10	4.0
	Total	24	9.6

TABLE 6: Distribution of cardiac death diagnoses stated by the Council of Forensic Medicine's 1st Specialization Board

Cause of death	n	%
Acute cardiorespiratory failure due to heart disease	101	40.4
Heart failure (acute, subacute, chronic)	58	23.2
Acute exacerbation of pre-existing heart disease	51	20.4
Sudden cardiac arrest	16	6.4
Cardiac tamponade	7	2.8
Cardiorespiratory failure due to sudden neurohumoral changes	6	2.4
Myocardial infarction	5	2.0
Heart disease and accompanying other diseases	5	2.0
Tetralogy of fallot	1	0.4
Total	250	100.0

(48.8%) cases examined histopathologically, supporting the presence of underlying heart disease.

Blood alcohol levels were analyzed in 175 (70%) of the cases included in this study. Among these, 144 cases had alcohol levels of 0 mg/dl, while 2 cases had levels exceeding 250 mg/dL.

Analyses for sedative/narcotic substances in blood revealed that only one case tested positive for these substances. In this particular case, 248 ng/mL morphine and 200 ng/mL benzodiazepine derivatives were detected.

Following assessment by the Council of Forensic Medicine's 1st Specialization Board, all cases (250 cases) were classified as cardiac death. The distribution of identified causes of death is presented in Table 6.

In one of the cases, it was reported that death occurred as a result of pressure applied to the neck region. The mechanism of death was explained as parasympathetic stimulation due to pressure on the carotid body, resulting in bradycardia, conduction block, and sudden cardiac arrest. In another case, the inhalation of ether triggered the individual's pre-existing heart condition, leading to death due to acute heart failure. In yet another case, death was associated with the combined effect of trauma and a detected blood alcohol level of 162 mg/dL; similar to the previous case, death occurred as a result of acute heart failure.

Among the 250 cases classified as sudden cardiac deaths by the First Specialization Board of the Council of Forensic Medicine, an analysis per decade revealed that, in the 10-19 age group, the most common cause of death (4 cases, 1.6%) was identified as cardiorespiratory failure due to sudden neurohumoral changes. In all other age groups, the most frequent cause of death was acute cardiorespiratory failure resulting from pre-existing heart disease.

In conclusion, trauma was associated with death in all 250 cases, but the causal relationship was only explicitly stated when requested by the courts as an additional consideration. Furthermore, when the courts asked whether the perpetrator's action involved intent to injure or intent to kill, the Board responded by stating that determining intent is not within the scope of forensic medicine.

DISCUSSION

According to various studies conducted by different researchers, sudden and unexpected deaths represent between 15-20% of all natural deaths.[19,20] Cardiovascular causes account for the majority of sudden deaths, comprising approximately 90% of such cases. Furthermore, around 50% of all cardiac-related deaths occur suddenly.[20,21]

Due to the high incidence of sudden cardiac death, exploring its relationship with trauma is common in forensic medicine practice.[18,*,**]

In this study, out of a total of 10,750 cases sent to and concluded by the First Specialization Board of the Turkish Ministry of Justice Council of Forensic Medicine between 1997-2001, 250 (2.3%) cases involving natural-origin sudden cardiac deaths associated with psychological and/or non-lethal physical trauma were examined. Similar studies by Sözen and Karadeniz reported rates of 4.9% (260 out of 5,230 cases) and 5.6% (338 out of 5,962 cases), respectively.[*,**]

The average age of cases included in this study was calculated as 51.3±17.3 years. In a study by Chugh et al. conducted in the United States involving 270 sudden cardiac death cases, the average age was

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42 years; however, the relationship with trauma was not investigated.[22] Fornes et al. conducted a French study of 377 sudden cardiovascular death cases without considering trauma. In their study, 221 coronary-related cases were divided into 2 groups: Group A (160 cases without cardiac antecedents) and Group B (61 cases with cardiac antecedents). The mean age for males in Group A was 64.08±1.66 and for females 76.49±1.61, while in Group B, it was 65.74±2.19 for males and 78.59±1.69 for females.[23] Another study by the same authors, which included 43 cases of sudden cardiac death associated with psychological stress, reported mean ages of 52 for males and 64 for females.[24]

Literature on sudden cardiac deaths linked exclusively to psychological stress includes a study by Leor et al. that observed a significant increase in sudden cardiac deaths on the day of the 1994 California earthquake, which gradually decreased over the subsequent week.[25] Trichopoulos et al. reported an increase in daily deaths from atherosclerosis from an average of 2.6 to 8 following the 1981 Athens earthquake. Meisel et al. observed increased cardiac complaints and out-of-hospital sudden deaths in Tel Aviv following missile attacks during the Gulf War, with sudden deaths nearly doubling from the previous year.[26,27] Lown discussed stress-induced arrhythmias leading to sudden cardiac deaths.[28]

A case report by Michalodimitrakis and Tsatsakis on sudden cardiac deaths due to commotio cordis caused by traffic accidents exemplifies deaths linked exclusively to physical trauma. Autopsies of 2 cases in their study revealed only contusions, measuring 5x3 cm over the fascia at the left 4th intercostal sternocostal junction in one case, and 2x4 cm on the left pectoral muscle in the other, with negative toxicological results in both.[29] Darrok et al. described a case from Austria involving death due to blunt chest trauma from a broken wooden wheel fragment, with autopsy revealing only coronary artery laceration.[30] Given similar findings in this study involving sudden cardiac deaths from traffic accidents, we suggest that commotio cordis should be considered in cases involving severe abdominal or thoracic trauma without clear traumatic or cardiac findings.

Comparing age distributions in this study with those of Sözen and Karadeniz, most deaths in this study occurred in the 7th decade (57 cases, 22.8%), whereas in the other studies, the 6th decade was most common, with 26 (29.8%) cases and 43 (38.7%) cases, respectively.[*,**]

Regarding gender distribution, these findings closely matched those of Goudevenos et al. in Northwestern Greece. In this study, 14% (35/250) were female and 86% (215/250) male, while in the other study, 18% (40/223) were female and 82% (183/223) male.[31]

In cases with known body weights, mean heart weights in this study were 408±106 g for males and 331±65 g for females. Fornes et al. reported mean heart weights of 446±11 g for males and 381±17 g for females without cardiac antecedents, and significantly higher weights in males with antecedents (513±24 g) compared to those without ($p<0.05$), suggesting differences in body size and composition as the cause for variance with findings.[23]

This study indicates that most symptoms (192 cases, 76.8%) and deaths (175 cases, 70%) occurred within one hour of the triggering event, consistent with studies by Leor et al., Chen and Huang, and Fornes et al.[23,25,32]

These findings align with other studies demonstrating a higher likelihood of sudden cardiac death in individuals with medical histories of coronary artery disease, diabetes, or hypertensive heart disease compared to otherwise healthy individuals, highlighting the importance of medical history in determining causality.[23,33]

In this study, autopsies were performed within the first 24 hours postmortem in 146 (58.4%) cases. The early diagnosis of myocardial infarction can be challenging, potentially leading to missed myocardial injuries, given that ischemic heart diseases constitute around 85% of sudden cardiac deaths.

Left ventricular wall thickness measurements in this study (105 cases, 42%) ranged from 0.8 cm to 4 cm, with a mean of 1.83±0.55 cm, indicating left ventricular hypertrophy, similar to findings by Chugh et al.[22]

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Autopsy findings most frequently revealed coronary artery disease and myocardial infarction as the leading causes of sudden cardiac death, followed by cardiomyopathies and valvular heart diseases, consistent with other studies.[22-24]

Differences between autopsy reports and Board decisions regarding cause of death may stem from the Board's use of simpler language to facilitate legal understanding rather than strictly medical terminology.

LIMITATIONS

This study has certain limitations that should be acknowledged. Autopsies were not conducted in all cases, and among those performed, a portion were not carried out by specialists in forensic medicine or pathology, which may have influenced the consistency of diagnostic findings. Furthermore, the autopsy protocols were not clearly documented in all cases, limiting the ability to assess the degree of standardization. In some instances involving post-event hospitalization, detailed treatment records were unavailable, and in a subset of cases, histopathological examinations were either not performed or not conducted according to standard procedures. These factors may have influenced the completeness and accuracy of the diagnostic assessments.

CONCLUSION

Accurate cardiac pathology diagnosis through timely autopsy performed with appropriate techniques, accompanied by tests and methods enabling early detection, is critical for correctly identifying sudden cardiac deaths potentially associated with psychological and/or non-lethal physical trauma. Such precise diagnosis is essential for achieving accurate and effective justice.

Conducting forensic autopsies by qualified forensic medicine specialists or forensic pathologists, rather than by general practitioners or physicians from other specialties, is essential for the accurate identification and interpretation of postmortem findings. Equally important is the performance of autopsies in all relevant cases, accompanied by thorough histopathological examination of the heart, to ensure precise determination of the cause of death, particularly in suspected cases of sudden cardiac death.

In establishing causality for such deaths, it is essential to thoroughly consider the circumstances of the event, eyewitness testimonies, relevant visual evidence, pathological findings documented during external examinations and autopsies, and any available medical records pertaining to the deceased prior to the incident. The absence of any of these criteria complicates the establishment of causality.

Regarding the determination of intent—whether the perpetrator's action involved intent to injure or intent to kill—the board's stance that this matter is judicial rather than medical aligns with expert ethics and professionalism. Such decisions must always remain within the jurisdiction of legal authorities.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Kağan Gürpınar, Mehmet Akif İnanıcı;* ***Design:*** *Kağan Gürpınar, Mehmet Akif İnanıcı;* ***Control/Supervision:*** *Kağan Gürpınar, Mehmet Akif İnanıcı;* ***Data Collection and/or Processing:*** *Kağan Gürpınar;* ***Analysis and/or Interpretation:*** *Kağan Gürpınar, Mehmet Akif İnanıcı;* ***Literature Review:*** *Kağan Gürpınar;* ***Writing the Article:*** *Kağan Gürpınar;* ***Critical Review:*** *Kağan Gürpınar, Mehmet Akif İnanıcı;* ***References and Fundings:*** *Kağan Gürpınar.*

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