

Sudden Suspected Death in Emergency Department: Autopsy Results

Acil Servisteki Ani, Şüpheli Ölümler: Otopsi Sonuçları

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SUMMARY

Objectives

Sudden deaths occur within 24 hours after symptoms' onset and are caused by cardiac, neurological and pulmonary diseases. Autopsy is the gold standard in determining cause of death. In this study, death's etiology was evaluated in cases applied to our department that underwent autopsy with sudden death indication.

Methods

This study included cases aged 18 or older with sudden, suspected, non-traumatic death applying to our department between 2008 and 2012. Patients' age, sex, death time, co-morbid diseases, initial signs, cardiac rhythm, and autopsy findings were recorded after reviewing patient charts.

Results

The study included 46 patients. Mean age was 45.73±19.6. Of the cases, 84.78% applied to emergency with cardiopulmonary arrest. Thirty-two cases (69.6%) were male. The most frequent cause of death was cardiovascular diseases (52.2%), followed by central nervous system disorders (21.7%), intoxications (15.2%), and respiratory diseases (10.9%). The most common diseases were myocardial infarction (45.7%), subarachnoid hemorrhage (8.7%), and chronic obstructive pulmonary disease. There were three drug ingestions, three carbon monoxide intoxications, and one corrosive material ingestion among the intoxication cases.

Conclusions

Sudden deaths are rarely encountered. Emergency clinicians should consider cause in differential diagnosis and provide appropriate approaches at first evaluation.

Key words: Autopsy; emergency service; sudden death.

ÖZET

Amaç

Ani ölümler semptomlar başladıktan sonra 24 saat içerisinde oluşur. En yaygın nedenleri kardiyak, nörolojik ve pulmoner hastalıkları içerir. Otopsi bu ölümlerin nedenini tespit etmede altın standarttır. Bu çalışmada acil servisimize başvuran ani ölüm olgularının otopsi bulgularına göre ölüm nedenlerini değerlendirdik.

Gereç ve Yöntem

Bu retrospektif çalışmaya 2008-2012 yılları arasında acil servisimize başvuran, yaşları 18 ve üzeri olan, nontravmatik, ani, şüpheli ölüm vakaları alındı. Hastaların dosyaları incelenerek yaşları, cinsiyetleri, ölüm zamanı, bilinen hastalıkları, semptomlar başladıktan sonra geçen zaman, başvuru anındaki şikayeti, vital bulguları ve otopsi sonucu kaydedildi.

Bulgular

Çalışmaya 46 hasta alındı. Ortalama yaş 45.73±19.6 idi. Vakaların %84.78' i acil servise geldiğinde kardiyopulmoner arrestti. 32 vaka (%69.6) erkekti. Ölümün en yaygın nedeni kardiyovasküler hastalıklardı (%52.2). Bunu nörolojik hastalıklar (%21.7), intoksikasyonlar (%15.2) ve solunum sistemi ile ilgili hastalıklar (%10.9) izledi. En sık gözlenen hastalıklar myokard infarktüsü (%45.7), subaraknoid kanama (%8.7) ve kronik obstruktif akciğer hastalığı (%6.6) idi. İntoksikasyon vakalarının üçü ilaç alımı, üçü karbonmonoksit zehirlenmesi, biri koraziv madde içimiydi.

Sonuç

Bu kritik hastaları ilk değerlendiren hekim olan acil servis doktorları, ölümlerin altında yatan nedenlerin ayırıcı tanısını yapmalı ve uygun tedavi yaklaşımını uygulamalıdır. Ani ölümlerin en sık nedeni kardiyovasküler hastalıklar olmakla birlikte acil serviste diğer nedenler de göz önünde tutulmalıdır.

Anahtar sözcükler: Otopsi; acil servis; ani ölümler.

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Introduction

The World Health Organization (WHO) definition of sudden death, a significant health problem is "death, occurring less than 24 hours from the onset of sudden changes in previous clinical condition".^[1,2] Sudden deaths are non-traumatic deaths.^[1] Autopsy should be performed in order to understand the cause of death in patients who die suspiciously and unexpectedly.^[2-4] Emergency rooms (ER), a significant entry to hospitals for the critically ill patients, play a crucial role in the treatment and health care of these patients. Management of these patients, who are brought to hospital with a life-threatening condition or with cardiopulmonary arrest, is difficult, and finding the underlying cause and treatment for that cause is challenging. Previous medical history of the patient could be unknown by the health team and family members of the patient who brought him/her to emergency room, or patient may not have a relative with him/her and this could be his/her first admittance to a hospital. In this circumstance, preexisting diseases of the patient are not disclosed. Most of these patients suffer cardiopulmonary arrest when they are brought to emergency room and a detailed medical history cannot be obtained because the event occurs suddenly and because of absence of eyewitness or family members witnessing the event.^[5] We therefore believe that determining the cause of sudden, unexpected deaths in emergency rooms is important in management of the critically ill patients admitted to emergency department.

The purpose of this study was to determine cause of death according to autopsy findings in patients who were brought to our emergency department and who died suddenly, unexpectedly, and non-traumatically.

Materials and Methods

Patients who died within 24 hours, were brought to our emergency department with cardiopulmonary arrest, did not have trauma marks in the body, and whose cause of death cannot be determined during the intervention in ER, as well as non-traumatic cases who died a short time after being admitted to the ER before a diagnoses could be made, were determined to have suffered from sudden, suspicious death. All patients in the study were 18 and over at the time of death. Medical records of the cases who were diagnosed as sudden suspicious death between 2008 and 2012 were analyzed retrospectively. Cause of death in these cases were recorded according to autopsy results. Prior to study, approval was obtained from Firat University ethical committee. Traumatic deaths and cases who were diagnosed during emergency intervention were excluded.

Statistical Analysis

Data obtained were transferred to SPSS 17.0 (Statistical Package for Social Science) program. Chi Square Test was used for statistical analysis of the data and they were evaluated in 95% confidence interval. A p value < 0.05 was considered statistically significant, and the average of data complying with normal distribution was given as arithmetic mean \pm standard deviation.

Results

During the five-year-period, 231 patients died in the ER. Among these cases, 46 (19.91%) were considered as sudden and suspicious death. The average age of the cases was 45.73 ± 19.68 (min:18-max:92) and 69.6% were male. Thirty-nine cases (84.78%) were brought to emergency department as cardiopulmonary arrest. The average time of stay in the emergency department was 41.95 ± 23.65 minutes (min:10-max:120 min.). According to autopsy reports, most common cause of death was cardiovascular disease (52.2%), followed by central nervous system diseases (21.7%), intoxications (15.2%), and respiratory diseases (10.9%) (Figure 1).

The most common disease was acute myocardial infarction (AMI) (n=20) among the cardiovascular diseases (n=24). This was followed by valve diseases (n=2), aortic dissection (n=1) and pulmonary emboli (n=1). One of the cases with valve disease was pregnant and had aortic stenosis, the other had mitral valve insufficiency.

Among central nervous system diseases (n=10), most common was subarachnoid hemorrhage (SAH) (n=4), followed by intracranial bleeding (n=2), asphyxia due to epileptic seizure (n=2), ischemic stroke (n=1), and meningitis (n=1).

Seven of the cases were intoxication patients. One of these cases took tricyclic antidepressant drug, one case took narcotic substance, one case took benzodiazepine, beta block-

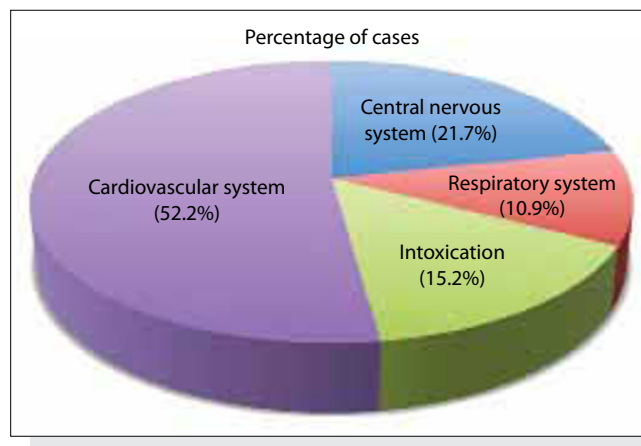


Figure 1. Distribution of cases according to causes of death.

Table 1. Causes of death in sudden death cases according to autopsy results

	n	%
Cardiovascular system		
Myocardial infarction	20	45.7
Heart valve disease	2	4.3
Aortic dissection	1	2.2
Pulmonary embolism	1	2.2
Central nervous system		
Subarachnoid hemorrhage	4	8.7
Epilepsy	2	4.3
Intracranial hemorrhage	2	4.3
Meningitis	1	2.2
Ischemic cerebrovascular disease	1	2.2
Respiratory system		
Chronic obstructive lung disease	3	6.6
Pulmonary failure	2	4.3
Intoxication	7	15.2
Total	46	100

oxide poisoning; one of them was affected from stove, one from water heater, and one from commercial liquefied petroleum gas.

Among respiratory diseases, three cases had respiratory failure due to chronic obstructive lung disease (COLD). One case had respiratory failure due to Behçet's disease, and one case had respiratory failure due to Wegener granulomatosis. Distribution of death causes of the cases according to autopsy results is shown in Table 1.

A statistically significant difference was detected in analysis done between gender of the cases and cause of death in autopsy reports (χ^2 4.493 p=0.035) (Table 2). Advanced analysis revealed that this significance originated from deaths due to cardiovascular causes and genders.

When causes of death and age groups were investigated, it was seen that central nervous system related deaths were higher among age groups between 18-29 and 40-49, while cardiovascular system related deaths were higher among other age groups (Table 3).

er and selective serotonin reuptake inhibitor, and one case took corrosive substance. Three cases were carbon mon-

Discussion

Sudden death is a very important public health problem

Table 2. Distribution of causes of death according to gender

Gender	Causes of death									
	Cardiovascular system		Central nervous system		Respiratory system		Intoxication		Total	
	n	%	n	%	n	%	n	%	n	%
Male	20	83.3	7	70.0	2	40.0	3	42.9	32	69.6
Female	4	16.7	3	30.0	3	60.0	4	57.1	14	30.4
Total	24	100	10	100	5	100	7	100	46	100.0

($\chi^2=4.493$, p=0.035).

Table 3. Distribution of causes of death according to age groups

Causes of death	Age groups					Total	
	18-29	30-39	40-49	50-59	60 and above		
	n	n	n	n	n	n	%
Cardiovascular system	3	7	1	4	9	24	52.2
Central nervous system	4	1	3	-	2	10	21.7
Respiratory system	2	-	1	1	1	5	10.9
Intoxication	2	1	1	2	1	7	15.2
Total	11	9	6	7	13	46	100.0

worldwide, and time interval between onset of symptoms and mortality is less than 24 hours.^[1] Autopsy is required to explain cause of death in these cases.^[2] Although it differs from one country to another, the most common cause of natural sudden deaths is cardiovascular disease, while central nervous system disease is second. We found that the most common non-traumatic sudden deaths in our emergency department occurred due to cardiovascular diseases (52.2%), followed by central nervous system disease (21.7%), intoxications (15.2%), and respiratory system diseases (10.9%).

It is reported that 78.4% of the suspected deaths occur at the scene.^[7] In our cases, 84.7% were brought to emergency room as cardiopulmonary arrest. However, since our study was a retrospective one, no information during file analysis could be achieved whether arrest was at the scene or on the way to ER.

Most common cardiovascular diseases that cause death include coronary heart disease, hypertrophic cardiomyopathy, aortic diseases, and pulmonary emboli.^[8] Cause of death in youngsters is different from adults. Congenital heart diseases, myocarditis, hypertrophic cardiomyopathy, and conduction system anomaly are the most common underlying causes below 20 years of age.^[9,10] Incidence of coronary artery disease increase with age and is most common above 30 years of age.^[10] Manfredini et al.^[11] found in a study in Italy that AMI was responsible for 55% of 732 sudden death cases, pulmonary emboli in 7.5%, aortic aneurism rupture in 3.8% and stroke in 2.3%. Thomas et al.^[12] reported 322 sudden death cases aged between 18-69 as a result of three-year-analysis. They detected ischemic heart disease in 58.7% of these cases, non-ischemic heart disease in 7.5%, respiratory disease in 17.7%, central nervous system disease in 4.3%, aortic aneurism in 3.4% and gastrointestinal bleeding in 2.2%. In our study, consistent with the literature, we found that non-traumatic suspicious deaths occurring in our emergency department were most commonly due to cardiovascular system diseases. AMI was present in 45.7% of the cardiovascular diseases and it constituted the most common disease group that caused death. Valve disease was the cause in 4.3% of the cases. In autopsy of one of these cases, aortic stenosis and pregnancy was detected, while mitral insufficiency was found in the other. Case with mitral stenosis had been brought to emergency department in arrest, following a severe exercise. Sudden death in aortic stenosis is well defined and can be precipitated by exercise. Increased cardiac demand associated with physical effort in presence of a fixed left ventricular outlet obstruction can lead to fatal ventricular arrhythmias.^[13]

Sudden deaths due to intracranial causes in the adults are

not uncommon among adults and can occur due to trauma, tumor, hemorrhage, ischemic stroke, and epilepsy. Lynch et al.^[14] examined 499 non-traumatic sudden death cases without known central nervous system abnormality according to autopsy and radiologic findings for 10 years. They found that 48 of these cases occurred due to central nervous system disease. Aneurism rupture was found in 11 of these 48 cases, hemorrhage in 9, tumor-cyst in 8, subdural hematoma in 5, sinus vein thrombosis in 4, meningitis in 3, infarction in 3, arteriovenous malformation in 2, cerebral abscess in 1, brain metastasis in 1, arterial dissection in one case. In our study, 10 cases died due to causes related with central nervous system. In four of these SAH was present, two had intraparenchymal bleeding, two had epilepsy, one had meningitis and one had ischemic stroke.

About 15% of the patients with subarachnoid hemorrhage died before being admitted to the hospital, and more than 20% died within 48 hours after onset of symptoms. Sudden deaths related to central nervous system can occur as a result of acute damage or suppression of vital centers. Central nervous system dysfunction or sudden increase in intracranial pressure can result in life-threatening arrhythmias. ECG alterations such as prolongation in QT interval, sharp or reverse T wave, depression or elevation in ST segment, non-sustained ventricular tachycardia, and R on T phenomenon can occur in SAH or other intracranial events.^[15,16] These alterations are associated with incompatibility of heart in autonomous control; the heart was found to be normal in autopsies of most of the patients who died because of central nervous system lesion. On the other hand, focal myocytolysis, myofibrillar degeneration, lipofuscin pigment accumulation in myocardium, and histiocyte accumulation in necrosis region were shown in various brain diseases. Autonomous nervous system and several chemical mediators are involved in pathogenesis.^[18] In autopsies of three cases, we did not find any other pathology that explains cause of death besides SAH in our study. SAH and aspiration were present in one case. No information on ECG alteration could be reached because cases suffered arrest when they were brought to emergency department.

Epilepsy is one of the most common serious neurologic disorders worldwide and risk of early death is 2-3 times greater compared to general population.^[17,18] Onset of epilepsy at early age, long and frequent seizures, generalized tonic clonic seizure, nocturnal seizures, dementia, presence of cerebrovascular disease, asthma, male gender, low anti-epileptic drug compliance, low anti-epileptic drug levels in post-mortem studies, and alcohol use are risk factors. Although the mechanism of death is not well known, cardiac arrhythmia, apnea, neurogenic pulmonary edema, obstructive respiratory failure, and positional asphyxia due to seizure were

suggested. In our study, three of 46 cases had history of epilepsy and it was found that one died because of AMI while two died asphyxia due to epileptic seizure.

Seven of the suspected, sudden death cases were diagnosed as intoxication at the end of autopsy. One of these cases took tricyclic antidepressant drug, one case took benzodiazepine, beta blocker and selective serotonin reuptake inhibitor, and one case took narcotic substance. These cases were brought to emergency department in arrest and diagnosis was made as a result of toxicologic investigation at the forensic medicine department. One of the three study subjects died due to carbon monoxide poisoning was affected from stove, one from water heater, and one from commercial liquefied petroleum gas. All these three cases were found in cardiopulmonary arrest in a closed environment. Autopsies of these cases revealed that cause of death was asphyxia due to carbon monoxide, while one case also had aspiration. Carbon monoxide poisoning should be taken into account in deaths occurring, particularly in closed areas.^[19]

There were five death cases associated with respiratory disease in our study. Among these, three cases had respiratory failure due to chronic obstructive lung disease (COLD), one case had respiratory failure due to Behçet's disease, and one case had respiratory failure due to Wegener granulomatosis. Intermittent hypoxia, Theophylline and catecholamines can cause ventricular arrhythmias in COLD patients, particularly in those with subclinical myocardial ischemia and sedative tranquilizers, which can lead to death by suppressing respiration.^[12] Two COLD cases in our study had been brought to emergency department in arrest and no explanation other than COLD could be found in their autopsies. In one case, the patient suffered cardiopulmonary arrest shortly after being brought to emergency department. Arrhythmia and ischemia sign was not found in ECG of that patient and it was seen in autopsy that no pathology was detected beside COLD.

Limitations

Since this study is retrospective, detailed information on complaints of the patients prior to arrest, time interval between onset of complaints and arrest, and risk factors for sudden death could not be attained.

Conclusion

Patients who are brought to the emergency department with cardiopulmonary arrest and no witness and die unexpectedly, or whose cause of death cannot be explained with existing disease and die shortly after being brought to the emergency department without diagnosis should be defined as sudden, suspected death and autopsy should

be performed in order to detect certain cause of death in these forensic cases. Cardiovascular disease is the most common cause underlying the on-traumatic, sudden, suspicious deaths, followed by central nervous system diseases. Acute myocardial infarction is the most important disease among these. We should keep in mind aortic dissection, pulmonary emboli, intoxications, and diseases involving central nervous system and respiratory system beside myocardial infarction in differential diagnosis of sudden death cases brought to emergency department. We believe that underlying causes of sudden and unexpected deaths are crucial in the management of emergency patients.

Conflict of Interest

The authors declare that there is no potential conflicts of interest.

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