

Sudden cardiac death behaviourism in deceased patients with autopsy protocol

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ABSTRACT

Introduction: Sudden cardiac death (SCD) remains an important public health problem considering its incidence rates and demographic data.

Objective: To characterize patients who died from SCD who underwent autopsy.

Method: A descriptive, retrospective and cross-sectional study was carried out in 83 patients who died owing to SCD in the emergency department and the area assisted by the «Hospital General Docente Aleida Fernández Chardiet», who underwent autopsy between the years 2014-2015. Contingency tables were made to identify statistically significant differences between the categories of some of the studied variables, and the Chi square statistical test showed a confidence level value of 95% ($p=0.05$).

Results: Average age was 65.36 years. 63.9% of the victims were male, and 66.3% white. Fifty-three percent of patients died from acute coronary syndrome; the most frequent cardiovascular risk factor was high blood pressure, up to 57.8% of cases. 61.4% died in the emergency department and were given resuscitation maneuvers. 19.3% died in the month of May and 34.9% between 06:00-11:59 hours.

Conclusions: Acute coronary syndrome was the most frequent cause of SCD while high blood pressure represented the commonest cardiovascular risk factor. Most of the patients died in the emergency department.

Key words: Sudden cardiac death, Sudden death, Risk factors, Acute coronary syndrome, Autopsy

Comportamiento de la muerte súbita cardiovascular en pacientes fallecidos con protocolo de necropsia

RESUMEN

Introducción: La muerte súbita cardiovascular (MSC) sigue siendo un problema de salud pública importante dadas las cifras de su incidencia y los datos demográficos.

Objetivo: Caracterizar los pacientes fallecidos de MSC sometidos a necropsia.

Método: Se realizó un estudio descriptivo, retrospectivo y transversal en 83 pacientes fallecidos de MSC en los servicios de urgencias y el área que atiende el Hospital General Docente Aleida Fernández Chardiet a los que se les practicó necropsia entre los años 2014-2015. Para identificar diferencias estadísticamente significativas entre las categorías de algunas de las variables estudiadas se confeccionaron tablas de contingencias y se obtuvo el valor de la prueba estadística Chi

cuadrado con un nivel de confianza del 95% ($p=0,05$).

Resultados: La edad media fue de 65,36 años. El 63,9% de las víctimas fueron del sexo masculino y el 66,3% de color blanco. El 53% de los pacientes falleció por un síndrome coronario agudo. El factor de riesgo cardiovascular más frecuente fue la hipertensión arterial con el 57,8% de los casos. El 61,4% falleció en los servicios de urgencias y se les aplicaron maniobras de reanimación. El 19,3% murió en el mes de mayo y el 34,9% entre las 06:00-11:59 horas.

Conclusiones: El síndrome coronario agudo fue la causa más frecuente de MSC y la hipertensión arterial el factor de riesgo cardiovascular más usual. La mayoría de los pacientes fallecieron en los servicios de urgencias.

Palabras clave: Muerte súbita cardiovascular, Muerte súbita, Factores de riesgo, Síndrome coronario agudo, Necropsia

INTRODUCTION

The unexpected death of one of its member represents a lamentable pain for a family. The sudden death is defined as the one which takes place from natural causes, unexpected in time and in its presentation, preceded by the abrupt loss of consciousness, that occurs within the first hour after the onset of symptoms. It represents around 10% of the total deaths. In 88% of cases, sudden death is due to a cardiac cause and then it is denominated sudden death, in a person with or without history of heart disease¹.

The sudden cardiac death (SCD) remains an important public health problem considering its incidence rates and demographic data. With an estimated average number between 300 and 350 thousand deaths per year in the USA alone, it is responsible for half of all cardiovascular deaths².

Only 5% of the victims of an out-of-hospital cardiorespiratory arrest manage to survive. The prognosis may improve if the event is recognized immediately, the cardiopulmonary resuscitation begins and there is a quick access to emergency services³.

Virtually, all structural heart diseases can cause sudden death, with clear predominance (greater than 80%) of the ischemic heart disease, although the hypertrophic cardiomyopathy, dilated cardiomyopathy or right ventricular dysplasia are also well responsible for a number of sudden deaths¹.

In the autopsies performed to the victims of a SCD, they have structural and vascular alterations of the heart, particularly, coronary atherosclerosis. In many cases, a recent rupture of an atherosclerotic plaque can be demonstrated, with or without intracavitary thrombosis³. The traditional cardiovascular risk factors for coronary atherosclerosis are

useful for identifying the level of risk in the population and in individuals, but they cannot be used to distinguish individual patients at risk of SCD².

All of the above was a motivation to conduct this study in order to characterize the patients who died of SCD.

METHOD

Type of study

A descriptive, retrospective and cross-sectional study was carried out in 83 patients who died due to SCD at the emergency department and the attention area of the *Hospital General Docente Aleida Fernández Chardiet*, who underwent autopsy between the years 2014-2015.

Inclusion and exclusion criteria

- Patients deceased due to SCD at the emergency room of the *Hospital General Docente Aleida Fernández Chardiet*, municipal intensive rooms, polyclinics or any other area belonging to the hospital outside the emergency services.
- Not to be admitted to the hospital institution.
- To be more than 18 years of age at death.
- To have performed the autopsy protocol.
- The exclusion depends on not meeting the inclusion criteria.

Variables

The age was evaluated as a qualitative variable and the quantitative variables were: sex, skin color, cause of death, risk factors, reanimation, the place of the SCD, month, and time of death.

Definition of sudden cardiac death

It is defined as the natural death of a cardiac cause that occurs within an hour after the onset of symptoms or patients who die within a period of up to 24 hours before being seen alive².

Collection of information

Data were collected from medical records gathered in the emergency room, medical death certificates, autopsy reports and data provided by the statistics department of the hospital. The main author also oversaw the quality of the information obtained through validation of primary data, through its proven revision, in order to minimize the slant of observation.

Statistical process

With the information obtained through the collection data form, a database in Excel Office 2007 was created, which was subsequently processed with the SPSS version 17. The quantitative variable was summarized by the arithmetic mean and standard deviation. The qualitative variables were summarized with the percentages. The results obtained were presented in tables of one and two entries. Contingency tables were made to statistically identify significant differences between the categories of some of the studied variables and the Chi square statistical test showed a confidence level value of 95% (p=0.05).

RESULTS

The average age in the cases studied was 65,36 years and males were the most frequent with 63.9% of the patients; on the other hand, the skin color that predominated was white, with 55 patients, what represented 66.3% of cases (**Table 1**).

More than half of the patients died due to an acute coronary syndrome (53%); in order of frequency it was followed by patients with acute coronary syndrome (ACS) and who were diagnosed a cardiomegaly confirmed by autopsy, with a report of 20 cases, which represented 24.1%. In 11 patients (13.3%) the cause of death was the dilated cardiomyopathy, its registry increased with age, affecting 54.5% after the sixth decade of life. The most affected age group was 60-79 years old, where 59.1% died from ACS, as well as 60% of patients with ACS and

cardiomegaly. Only in a patient under 40 years the cause of death could not be determined, accounting for 1.2% (**Table 2**).

Table 1. Distribution of deceased patients according to demographic variables.

Variable	Nº	%
Age (years)*	63.36±13.7	
Sex		
Male	53	63.9
Female	30	36.1
Skin color		
White	55	66.3
Black	15	18.1
Mixed	13	15.6

* The values expressed mean ± standard deviation.

Source: Autopsies' protocols.

As shown in **table 3**, the most common risk factor was high blood pressure with 57.8% of the patients, and it affected primarily males, with 26 patients (54.2%). The records of coronary disease were also relevant, because it was found in the 39.7% of the victims, especially women (69.7%); these results were highly significant (p < 0.001). Other risk factors, such as smoking, diabetes mellitus and obesity, continued in order of frequency. The alcoholism was registered in only two patients (2.4%).

The 61.4% of the deceased patients had cardiopulmonary resuscitation (CPR), 47 of them (95.9%) at the emergency department; only 11.8% of the deceased outside the emergency services received CPR. These results were statistically significant ($\chi^2=60,0$; p<0,001). However, a lot of patients who were not resuscitated (88.2%) were victims of SCD away from the emergency department (**Table 4**).

In the initial months of the year, the SCD registration experienced a descent, reaching the month of March with the lowest number of victims (2.4%); however, from this moment on it began to rise, being May the month with most of the registered deaths, with 19.3% of reported cases. It remained stationary in June and July, with 10.8% of patients, to subsequently fall and behave with little variation the last three months (**Figure 1**).

Table 2. Distribution of cases according to the cause of death and age groups.

Causes	Age (years)								Total (n=83)	
	< 40		40-59		60-79		≥ 80			
	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%
ACS	1	2.3	11	25.0	26	59.1	6	13.6	44	53.0
ACS and cardiomegaly	0	0.0	3	15.9	12	60.0	5	25.0	20	24.1
Dilated cardiomyopathy	1	9.1	4	36.4	6	54.5	0	0.0	11	13.3
Arrhythmias	0	0.0	1	20.0	2	40.0	2	40.0	5	6.0
Hypertrophic cardiomyopathy	2	100	0	0.0	0	0.0	0	0.0	2	2.4
Unknown	1	100	0	0.0	0	0.0	0	0.0	1	1.2

ACS, acute coronary syndrome
 $\chi^2= 49.182$; $p<0.001$

Table 3. Distribution of patients who died of SCD according to cardiovascular risk factors and sex.

Risk factors	Sex				Total (n=83)		p
	Female		Male				
	Nº	%	Nº	%	Nº	%	
High blood pressure	22	45.8	26	54.2	48	57.8	0.031
Ischemic heart disease	23	69.7	10	30.3	33	39.7	<0.001
Smoking	7	38.9	11	61.1	18	21.6	0.784
Diabetes mellitus	6	40.0	9	60.0	15	18.0	0.731
Obesity	3	33.3	6	66.7	9	10.8	0.852
Dyslipidemia	3	60.0	2	40.0	5	6.0	0.252
Alcohol	1	50.0	1	50.0	2	2.4	0.679

Fuente: Historias clínicas del Sistema de Urgencias.

Table 4. Distribution of deceased patients according to resuscitation and place.

Resuscitated	Place				Total (n=83)		p
	Out of the ED		At the ED				
	Nº	%	Nº	%	Nº	%	
Yes	4	11.8	47	95.9	51	61.4	<0.001
No	30	88.2	2	4.1	32	38.6	

Source: Medical records of the Emergency System. ED, Emergency Department.

$\chi^2= 60.00$; $p<0.001$

The SCD showed a characteristic circadian rhythm during the morning, when the largest number of patients (39.4%) –significantly– died; it descended in the afternoon, and rose by 20:00-23:59

hours, with a record of 22.9% of deaths. For an 8.4% of the victims, the time of the event could not be determined (**Figure 2**).



Figure 1. Distribution of deceased patients due to SCD according to the months of the year.



Figure 2. Distribution of patients who died from SCD according to the time of death.

Source: Autopsies' protocols.

DISCUSSION

In the present study, male patients died more frequently than females, especially those in the sixth decade of life and of white skin. In the bibliography reviewed, the incidence of SCD starts rising after the age of 55 years and peaks between 60 and 69 years^{4,5}; Braggion-Santos *et al.*⁶, in their study of SCD in Ribeirao Preto, Brazil, according to autopsies' reports, that included 899 deceased, found that 67% were male, 75% white and the largest percentage (27%) of victims had between 60-69 years.

Nevertheless, in studies made in China, the average age was much lower than ours, it was on the third and fourth decades of life^{7,8}. It is thought that age may vary depending on the sample, although the generality of the reviewed bibliography agrees in the rise of SCD after 60 years.

The atherosclerosis plays a fundamental role in SCD. The generality of deceased patients presents evident signs of rupture of a recent atheromatous plaque; it is not surprising that the ACS ranks first in the causes of death. In the series by Ochoa Montes *et al.*⁹ entitled “*Estudio clínico patológico sobre la muerte súbita cardíaca*”, in e l Arroyo Naranjo municipality of our capital, there was exposed that

58.9% of the deceased suffered an acute myocardial infarction. Likewise, Wang *et al.*⁸ found, in 553 deceased of SCD, who had an autopsy, that 50.3% presented important coronary atherosclerosis.

The dilated cardiomyopathy appears as an increasingly common cause of SCD, to have extended the life expectancy of the population and increased the survival of different cardiac diseases, which can produce it. The cardiac dilation, anatomic destructuring and alterations to the automatism and conduction of electrical activity can cause ventricular arrhythmias, generally polymorphic, very poorly tolerated hemodynamically and finally, responsible for the sudden death¹. In the present research, it was the third cause; however, this varies with the consulted works, although agrees that cardiomyopathies, ischemic or non-ischemic, dilated or hypertrophic are a non-negligible source precipitating the SCD^{6,8,10,11}.

The risk factors for coronary atherosclerosis are related to the risk of having an SCD. In this work, the high blood pressure (HBP) and a history of ischemic heart disease were the most frequent. Lewis *et al.*¹², in a research of a year in North Carolina (United States), on the incidence and risk factors of SCD, found that the HBP was the most common risk factor. Other series consulted reveal the same results

6,7.

Almost half of the deaths due to SCD take place at the residence, where there is no staff and resources to detect and adequately resuscitate the victims. In more than 50% of the patients included in this study, the cardiorespiratory arrest occurred in an emergency room where the patient was resuscitated. Wu *et al.*⁷ showed, in a series of 1411 cases, that 46.4% died at the hospital. Nonetheless, other studies inform an increased number of patients who died at their residence⁶. It is believed that our results are consistent with the creation of municipal wards of intensive care in the country, which enabled quick access to the emergency services.

In the work presented herein, the highest number of deaths from SCD were registered in the months of April and May and in the morning hours. The timing of this event is well known, which usually takes place in the morning, Mondays and during the winter¹³.

Other publications agree that the time of year where most cases are registered is in May,^{6,7}. Only in the series by Ben Ahmed *et al.*, the maximum number of events took place during the winter, with the peak in December and the nadir in September ($p=0.0001$)¹⁴. More extensive studies are needed to confirm or reject the above.

In the study of Messa-López *et al.*¹⁵, for 18 months in the *Comunidad Autónoma de Castilla y León*, Spain, based on a large population database, a circadian variation was observed in the appearance of the out-of-hospital cardiac arrest, without detecting differences related to the initial evolution of the cases. A predominant peak at the first morning hours was appreciated and one in the afternoon, as well as a clear drop in the evening hours, consistent with the findings of others studies.

Other publications, on temporary variations of cardiovascular events, have analyzed different assumptions to justify such factors as trigger factors at certain times of the day, and physiological or pathological phenomena precipitating the cardiovascular process, such as the sympathetic tone, platelet activity and others¹⁶. There have also been referred as triggers of this process, different types of physical activity and changes on the room temperature¹⁷.

CONCLUSIONS

The acute coronary syndrome was the most fre-

quent cause of sudden cardiac death and the high blood pressure was the most common cardiovascular risk factor. Most of the patients died at the emergency department.

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