CAUSES OF SUDDEN CARDIAC DEATH- AN AUTOPSY STUDY

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ABSTRACT

BACKGROUND

Sudden death is defined in many different ways by different authorities. Some believe that the term should be restricted to those cases wherein the time of onset of symptoms to 'collapse and death', is instantaneous or within minutes. In forensic parlours, "sudden death" is defined in a little different way as an 'apparently normal person, who is not known to be suffering from any illness, suddenly falls ill and dies within 24 hours of onset of the disease symptoms. In short 'sudden death' is restricted to natural causes only. Sudden unexpected natural death cases in adults are steadily increasing world over and is an issue of great concern for medical professionals. Sudden death especially of a young and apparently healthy adult is not only shocking but also has profound impact on the psyche of the society. Most of the sudden deaths occur outside the hospitals and in the emergency rooms, reflecting their unexpected character. As per the Indian law, all cases of sudden unexpected deaths or deaths in which the cause of death was not diagnosed or ascertained by the doctor, should be subjected to medico-legal autopsy.

Objectives-

1. To find out the age and sex distribution of victims who died of 'sudden cardiac death'.
2. To find out the aetiological factors associated 'with sudden cardiac death'.

MATERIALS AND METHODS

Study design- Retrospective case series study.

Sample size- 230 cases of sudden natural death brought for autopsy.

Source population- All cases of sudden natural death brought for autopsy to the Department of Forensic Medicine Government Medical College, Kottayam during the year 2016.

Inclusion Criteria- All autopsies in which death was due to sudden natural death were included in the study.

Exclusion criteria-

1. All unidentified bodies.
2. All decomposed bodies.

Data collection- Baseline data like age, sex, history of any previous illness, and a brief history of the case were collected from the requisition provided by the investigating officer. Details of the post-mortem findings were collected from the post-mortem certificate.

Analysis- Data collected was entered in MS-Excel and analysed using SPSS version 15.

RESULTS

Among the 230 cases of sudden natural death, 155 (67.4%) were due to occlusive coronary artery disease, a natural disease of the heart. The next most common cause was Pneumonia, 19 (8.3%) cases; followed by Cerebrovascular disease, 17 (7.4%) cases; Pulmonary tuberculosis, 9 cases (3.9%); Chronic obstructive pulmonary disease, 6 (2.6%) cases; Ruptured oesophageal varices, 5 (2.2%) cases; and septicaemia 4 (1.7%) cases.

CONCLUSION

Occlusive coronary artery disease is the most common cause of sudden natural death (67.4%). The age group most commonly involved in sudden cardiac death was 51-60 years (27.7%) followed by 61-70 years (21.3%) and 41-50 years (19.4%). 41 to 70 years age group is the most vulnerable group (68.4%) to be affected by sudden cardiac death. Among those involved in sudden cardiac death, 83.8% were males. Atherosclerosis is the dominant cause of cardiovascular disease including myocardial infarction. The most common coronary artery affected by atherosclerosis was the anterior descending branch of the left coronary artery (93.5%). The right coronary artery was affected in 65.8%. Coronary thrombosis is the reason for most cases of sudden cardiac death.

KEYWORDS

Sudden Death, Coronary Thrombosis, Autopsy.

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BACKGROUND

Majority of cases dealt with by forensic surgeons entail violence against human body, whether accidental, suicidal, or homicidal, there is still another large group of deaths which has to be investigated by them, a condition termed as, "sudden death due to natural causes". Sudden death may occur due to emotional excitement, mental tension, or arduous physical exercise in the presence of other people, or while alone or sleeping in the bed, when suspicion may arise as to the manner

and cause of death. The deceased would have been apparently normal, but would have had some pre-existing disease like coronary or cerebrovascular disease and the precipitating factor would be inconsequential, like a fall or a blow which is 'simple' in nature. In other cases, there may be a well-recognised clinical history and hospital record, which allows the forensic surgeon for determining the cause of death free from any serious doubt. But in practice many of them present with little or no history and that are what comprise one of the most perplexing challenges even an accomplished forensic surgeon has to deal with.

Sudden death is defined in many different ways by different authorities. Some believe that the term should be restricted to those cases wherein the time of onset of symptoms to 'collapse and death', is instantaneous or within minutes. In forensic parlours, "sudden death" is defined in a little different way as an 'apparently normal person, who is not known to be suffering from any illness, suddenly falls ill and dies within 24 hours of onset of the disease symptoms. In short 'sudden death' is restricted to natural causes only. Sudden unexpected natural death cases in adults are steadily increasing world over and is an issue of great concern for medical professionals.¹ Sudden death especially of a young and apparently healthy adult is not only shocking but also has profound impact on the psyche of the society.² Most of the sudden deaths occur outside the hospitals and in the emergency rooms, reflecting their unexpected character.³ As per the Indian law, all cases of sudden unexpected deaths or deaths in which the cause of death was not diagnosed or ascertained by the doctor, should be subjected to medico-legal autopsy.⁴

Sudden natural death accounts for approximately 10% of all deaths.⁵ Sudden cardiac death is commonly defined as an unexpected natural death due to cardiac causes.⁶ Diseases of cardiovascular system account for 45% to 50% of all sudden deaths.⁷ At least 80% of patients who experience sudden cardiac death have coronary artery disease as the underlying anatomic substrate due to atherosclerotic changes of the coronary arteries. Left ventricular failure and cardiogenic shock is the most feared complication of acute myocardial infarction.⁶ The number of sudden deaths is increasing to a great extent these days due to many risk factors like life-style diseases, fast food culture, addictions like smoking and alcoholism, sedentary life styles and occupation, etc.⁸ It is estimated that about 40-50% of all cardiovascular deaths are sudden cardiac deaths. As per WHO statistics, mortality due to cardiac causes has overtaken mortality due to all cancers put together.⁹ Approximately 4280 out of every one lakh people die every year from sudden cardiac death in India alone.¹⁰ Prevention of cardiovascular disease by increasing awareness of risk factors such as lack of exercise, inappropriate diet and smoking has reduced cardiovascular mortality in developed countries over the past few decades. Therefore, there is a need to develop complementary strategies for management of sudden cardiac death in our country. Atherosclerotic coronary artery disease is the underlying cause of approximately 75 to 90 percent of sudden cardiac deaths.^{11,12}

Objectives

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MATERIALS AND METHODS

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Retrospective case series study.

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Analysis

Data collected was entered in MS-Excel and analysed using SPSS version 15.

RESULTS

During the year 2016, 230 cases of sudden natural death were brought for autopsy in the Department of Forensic Medicine, Govt. Medical College, Kottayam.

Types of diseases causing sudden natural death:

There were 230 cases of sudden natural death brought for autopsy to the Department of Forensic Medicine Govt. Medical College, Kottayam in the year 2016. Among the 230 cases of sudden natural death, 155 (67.4%) were due to Occlusive coronary artery disease, a Natural disease of the heart.

The next most common cause was Pneumonia, 19 (8.3%) cases; followed by Cerebrovascular disease, 17 (7.4%) cases; Pulmonary tuberculosis, 9 cases (3.9%); Chronic obstructive pulmonary disease, 6 (2.6%) cases; Ruptured oesophageal varices, 5 (2.2%) cases; and septicaemia 4 (1.7%) cases.

There were 2 cases each of death due to myocarditis, Brain abscess, Pyelonephritis, Aortic dissection and Pancreatitis.

There was one case each of Liver abscess, Ectopic pregnancy, Anomalous origin of left coronary artery, hypertrophic cardiomyopathy and Dengue fever.

	Type of Disease	No. of Cases	%
1	Coronary artery disease	155	67.4
2	Pneumonia	19	8.3
3	Cerebrovascular disease	17	7.4
4	Pulmonary Tuberculosis	9	3.9
5	COPD	6	2.6
6	Rupture of oesophageal varices	5	2.2
7	Septicaemia	4	1.7
8	Myocarditis	2	0.9
9	Brain abscess	2	0.9
10	Pyelonephritis	2	0.9
11	Aortic dissection	2	0.9
12	Pancreatitis	2	0.9
13	Liver abscess	1	0.4
14	Ectopic pregnancy	1	0.4
15	Anomalous origin left coronary artery	1	0.4
16	Hypertrophic cardiomyopathy	1	0.4
17	Dengue fever	1	0.4
	Total	230	100

Table 1. Types of Diseases Causing Sudden Natural Death (N=230)

Figure 1. Causes of Sudden Natural Death

Age Distribution of Occlusive Coronary Artery Disease

The vast majority of cases were in the age group of 51-60, 43 cases (27.7%); followed by 61-70 age group, 33 cases (21.3%); and 30 cases (19.4%) were in the 41-50 age group. This was followed by 16 cases (10.3%) and 15 cases (9.7%) in the 31-40 and 71-80 age groups respectively. There were only 9 cases (5.8%) and 8 cases (5.2%) in the 21-30 and 81-90 age group respectively. There was only one case in the 10-20 age group.

Age Group	Incidence	Percentage
10-20	1	0.6
21-30	9	5.8
31-40	16	10.3
41-50	30	19.4
51-60	43	27.7
61-70	33	21.3
71-80	15	9.7
81-90	8	5.2
Total	155	100

Table 2. Age Distribution of Sudden Cardiac Death (N=155)

Figure 2. Age Distribution of Sudden Cardiac Death

Sex distribution of sudden cardiac death

Out of 155 cases of death due to sudden cardiac death, there were 130 males (83.8%) and 25 (16.2%) females.

Sex	Incidence
Male	130
Female	25
Total	155

Table 3. Sex Distribution Sudden Cardiac Death (N=155)

Figure 3. Sex Distribution of Sudden Cardiac Death

Distribution of Atherosclerotic Changes in Aorta and Coronaries

Among the 155 cases of death due to occlusive coronary artery disease, 116 (74.8%) cases showed atheromatous changes in the aorta. In 39 cases (25.2%) no atheromatous changes were noted.

Among the 155 cases of cardiac death, 145 (93.5%) cases showed atheromatous narrowing of the anterior descending branch of the left coronary artery. In 102 (65.8%) cases, the right coronary artery showed atheromatous changes. Only 30 cases (19.4%) showed atheromatous changes in the circumflex artery.

Site	Distribution	Percentage
Aorta	116	74.8
LAD	145	93.5
RCA	102	65.8
Cx	30	19.4
Total	155	100

Table 4. Distribution of Atherosclerotic Changes in Aorta and Coronaries (N=155)

Figure 4. Distribution of Atherosclerotic Changes in Aorta and Coronaries

Distribution of Thrombus in the Coronary Arteries

Out of 155 cases of sudden cardiac death, thrombus was detected in the anterior descending branch of left coronary artery in 37 cases (23.9%). In 16 cases (10.3%) thrombus was detected in the right coronary artery and in only 6 cases (3.9%) thrombus was noted in the circumflex branch of the left coronary artery.

Site	Thrombus	Percentage
Anterior descending branch of left coronary(LAD)	37	23.9
Right coronary(RCA)	16	10.3
Circumflex (Cx)	6	3.9

Table 5. Distribution of Thrombus in the Coronary Arteries (N=155)

Figure 5. Distribution of Thrombus in Coronary Arteries

Distribution of Myocardial Fibrosis

Among the 155 cases of sudden cardiac death, 56 cases (36.1%) showed fibrosis or scarring of the left ventricle. Only 9 cases (5.8%) showed scarring of the right ventricle.

Site	Fibrosis	Percentage
Left Ventricle	56	36.1
Right Ventricle	9	5.8

Table 6. Distribution of Myocardial Fibrosis (N=155)

Hypertrophy of Heart

Out of 155 cases of cardiac death, 32 cases (20.6%) showed hypertrophy of the left ventricle. Right ventricle was thickened in 8 cases (5.2%).

Site	Hypertrophy	Percentage
Left ventricle	32	20.6
Right ventricle	8	5.2

Table 7. Hypertrophy of Heart (N=155)

Miscellaneous Findings

Hypoplasia of the anterior descending branch of the left coronary artery was noted in 4 cases (2.6%). There were 6 cases (3.9%) of Hypoplasia of the right coronary artery. There were 2 cases (1.3%) of sudden death due to cardiac tamponade following rupture of heart as a complication of myocardial infarction.

Site	No. of Cases	Percentage
Hypoplasia LAD	4	2.6
Hypoplasia RCA	6	3.9
Cardiac tamponade	2	1.3

Table 8. Miscellaneous Findings (N=155)

Figure 6. Miscellaneous Findings

DISCUSSION

A retrospective case series study was conducted in the Department of Forensic Medicine on cases of sudden natural death brought for post-mortem examination during the year 2016. There were 230 cases of sudden natural death out of which the vast majority of cases, 155 (67.4%), were death due to occlusive coronary artery disease. This is in accordance with data available in Taylor's Principle and Practice of Medical jurisprudence, in which the incidence of death due to occlusive coronary artery disease was 58%.¹³ Sudden cardiac death accounts for ≈50% of the estimated 500000 cardiovascular deaths that occur annually in the United States, and a vast majority are the result of coronary artery disease.¹⁴

The age group most commonly involved was 51-60 years 43 cases (27.7%), followed by 61-70 years, 33 cases (21.3%) and those of 41-50 years, 30 cases (19.4%). Thus, it is clear that if we took the age group 41-70 years there are 106 cases (68.4%) out of the total of 155 cases of death due to occlusive coronary artery disease. Thus, the age between 40 to 70 years is the most vulnerable group. Among the 155 cases of sudden death due to occlusive coronary artery disease, 130 cases (83.8%) were males and only 25 cases were females. The risk was 2 to 3-fold higher in men than in women, and increased with age.¹⁵

Atherosclerosis is the dominant cause of cardiovascular disease including myocardial infarction, heart failure, and stroke. Atherosclerosis is mainly located in the intima of many middle sized and large arteries, especially where the vessels divide. In the present study, among the 155 cases of occlusive coronary artery disease, the most commonly involved artery

was the anterior descending branch of the left coronary artery, 145 cases (93.5%). The right coronary artery was affected in 102 cases (65.8%). The circumflex branch of the left coronary artery was the least involved, 30 cases (19.4%). Because coronary artery disease is an important manifestation of the disease, epidemiologic data related to atherosclerosis mortality typically reflect deaths caused by ischaemic heart disease (IHD).¹⁶

Coronary thrombosis is the reason for most cases of sudden cardiac death. In the present study, the most commonly affected vessel was the anterior descending branch of the left coronary artery, 37 cases (23.9%); followed by proximal part of right coronary artery, 16 cases (10.3%); and lastly circumflex branch of the left coronary artery, 6 cases (3.9%). Impaired endothelium may abnormally reduce vascular perfusion, produce factors that decrease plaque stability, and augment the thrombotic response to plaque rupture.¹⁷ Coronary thrombosis may occur on the ulcerative atheromatous lesions usually or even in virtually normal arteries especially in middle aged women where thrombosed aneurysms may be seen. Such aneurysms occur usually in right coronary artery.¹⁸

CONCLUSION

1. Occlusive coronary artery disease is the most common cause of sudden natural death (67.4%).
2. The age group most commonly involved in sudden cardiac death was 51-60 years (27.7%), followed by 61-70 years, (21.3%), and 41-50 years (19.4%).
3. 41 to 70 years age group is the most vulnerable group (68.4%) to be affected by sudden cardiac death.
4. Among those involved in sudden cardiac death, 83.8% were males.
5. Atherosclerosis is the dominant cause of cardiovascular disease including myocardial infarction.
6. The most common coronary artery affected by atherosclerosis was the anterior descending branch of the left coronary artery (93.5%). The right coronary artery was affected in 65.8%.
7. Coronary thrombosis is the reason for most cases of sudden cardiac death.

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