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Original Article

Sudden Cardiac Deaths in a Metropolitan City of South India: A Prospective Study

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ABSTRACT

Many cases of sudden unexpected natural deaths occur in individuals without known medical diseases. Among them sudden cardiac death (SCD) remains an important worldwide public health problem. The epidemiology of SCD in India continues to be understudied. In this prospective an autopsy series was conducted at KIMS hospital Bangalore and various parameters were analysed, such as the frequency of SCDs among the autopsies conducted, the demographic profile and the causes for SCDs. Out of 760 autopsied victims during an 18-month study period, 88 cases were of sudden natural deaths. Among them 60 cases of sudden natural deaths were selected for the study based on purposive sampling. Among the 60 cases of sudden natural deaths, 38 cases (63.3%) were due to SCD. Maximum number of victims (47.3%) observed were in the age group of 41-50 years. Males constituted 92.1% of the total victims. Maximum cases were observed in the middle-class society (47.3%). Majority of the victims (78.9%) were from urban areas. Majority of the victims (73.6%) had a mixed diet. All the victims were habituated to smoking and alcoholism (50%) each. 39.57% of the study population were hypertensive and 31.57% were diabetics. Maximum number of victims (47.36%) succumbed to death within 6-12 hours of onset of terminal symptoms. Majority of the victims (63.15%) died due to occlusive coronary artery disease.

Keywords: Sudden cardiac death, India, Postmortem, Sudden natural deaths, Coronary artery disease, Mortality, Demography

INTRODUCTION

Sudden cardiac death (SCD) is defined as death due to cardiac causes, in which the time and mode of death is unexpected, in an individual with or without pre-existing cardiac disease, which occurs within 1 hour of the onset of the heralding symptoms[1]. Some authorities have defined SCD as an unexpected death due to cardiac causes that occurs in a short time period (generally within 1 hour of symptom onset) in a person with known or unknown cardiac disease. It has been estimated that more than 7 million lives per year are lost to SCD worldwide[2]. The incidence of SCD ranges from 36 to 128 per 100,000 inhabitants per year in different communities[3]. Cardiovascular diseases are the leading cause of mortality in the adult population and this trend is seen globally including the low- and middle-income countries with the notable exception of countries in the sub Saharan Africa[4,5]. Patients at risk for SCD may have prodromes of chest pain, fatigue, palpitations and other nonspecific complaints. Factors relating to the development of SCD include the following: Family history of premature coronary artery disease, smoking dyslipidaemia, hypertension, diabetes, obesity and sedentary lifestyle. Coronary atherosclerosis is however the leading cause of SCD and hence called the captain of men of death[6]. The most common electrophysiological mechanisms leading to SCD are tachyarrhythmias such as ventricular fibrillation (VF) or ventricular tachycardia (VT) [7].

The epidemiology of SCD in India continues to be understudied. Hence, a prospective autopsy study was undertaken in the state of Karnataka, India at Bangalore to note and statistically analyse various parameters contributing to sudden death, such as the frequency of SCDs among the autopsies conducted, the demographic profile and the causes for SCDs.

METHODOLOGY

A prospective-descriptive autopsy study of sudden natural death cases that were conducted at KIMS hospital, Bangalore, Karnataka, for a period of 1½ years from 1st January 2011 to 31st May 2012 formed the primary material of the study. Among them cases of SCD was selected based on purposive sampling. The objectives were to assess the frequency of SCDs among the autopsies conducted, describe the demographic profile of sudden natural deaths and to assess the causes for sudden natural deaths. Before starting the post-mortem examination, history about the onset of symptoms, their duration, habits, family history, previous medical history and any treatment records if available were obtained from the relatives and recorded on a pre-made detailed performa. In cases where the death was unwitnessed and the dead body was brought directly from the site of death by police for post-mortem examination, help of police investigating officer was taken to know the manner of death.

Using Ghon's en bloc technique, the heart was carefully removed and examined by taking weight and further dissecting it by using the standard 'along the flow of blood technique'. The whole heart in some cases and pieces of heart in some cases, showing gross pathologic changes, were preserved for histopathology examination in 10% formalin solution and were forwarded to the Pathology department after taking consent from the relatives. Discussion was held with the clinicians who have treated the deceased person in admitted cases.

Only after the receipt of the histopathology report the final opinion regarding the cause of death was given. Data were collected and analysed statistically with respect to age, sex, personal habits like, diet, smoking, alcohol consumption, drug intake, diseases like diabetes and hypertension, socioeconomic status, time, place and activity at the time of incident and cause of death.

OBSERVATIONS AND RESULTS

Maximum number of cases, that is 18 deaths (47.3%), was observed in the age group of 41-50 years, followed by 14 deaths (36.8%) in the age group of 31-40 years (Figure 1, Table 1). Out of the 38 cases of SCD studied males dominated females in number of deaths by far, that is 35 cases were male (92.1%) and 3 cases were female (7.89%) (Figure 2, Table 2). The sex ratio of deaths of males to females was 11.6:1. Maximum deaths were observed in the population belonging to the middle-class society, 18 cases (47.3%) followed by 12 cases (31.57%) belonging to the lower class society (Figure 3, Table 3). Among this study population, majority of the victims, that is 30 cases (78.94%) were from urban localities and 8 cases (21.06%) were from rural locality (Figure 4, Table 4). Focusing on dietary habits in relation to SCD majority of the victims, that is 28 cases (73.6%) had a mixed diet and 10 victims (26.32%) were purely vegetarians (Figure 5, Table 5). Furthermore, while correlating personal habits known to be high risk factors for SCD such as smoking and alcoholism, we observed that all the victims (19 cases each, 50%) were habituated to smoking and alcoholism

Table 1: Age-wise distribution of sudden cardiac deaths

Age group (years)	No. of cases	Percentage (%)
11-20	0	0
21-30	1	2.63
31-40	14	36.8
41-50	18	47.3
51-60	2	5.26
61-70	1	2.63
71-80	1	2.63
81-90	1	2.63
Total	**38**	**100**

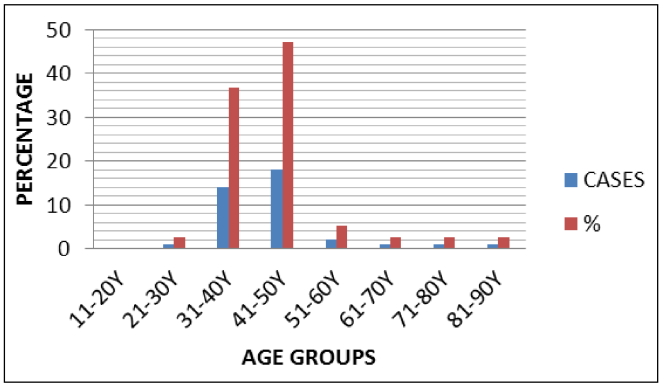

Figure 1: Age-Wise Distribution of SCD

Table 2: Sex-wise distribution of sudden cardiac deaths

Sex	No. of cases	Percentage (%)
Male	35	92.1
Female	3	7.89
Total	**38**	**100**

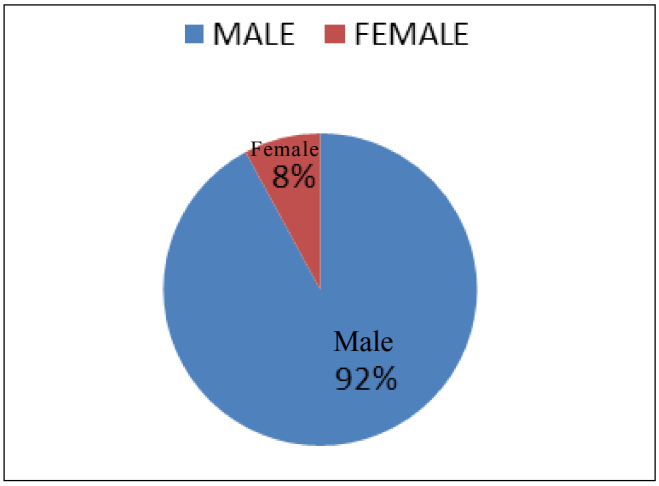

Figure 2: Sex-Wise Distribution of SCD

Table 3: Incidence of sudden cardiac deaths based on socioeconomic status

Socioeconomic Status	No. of cases	Percentage (%)
Lower class	12	31.57
Middle class	18	47.36
Upper class	8	21.06
Total	**38**	**100**

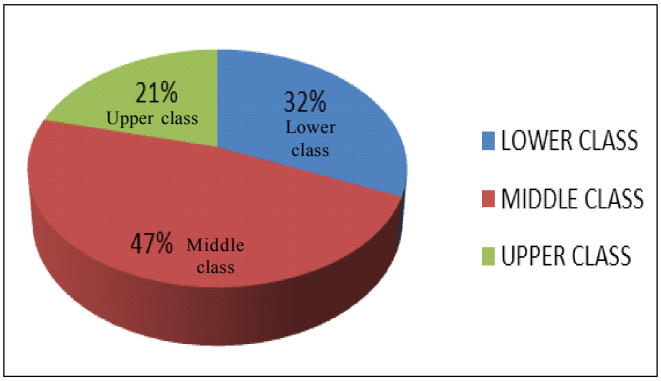

Figure 3: Incidence of SCD based on Socioeconomic status

Table 4: Incidence of sudden cardiac deaths based on locality

Locality	No. of cases	Percentage (%)
Urban	30	78.94
Rural	8	21.06
Total	**38**	**100**

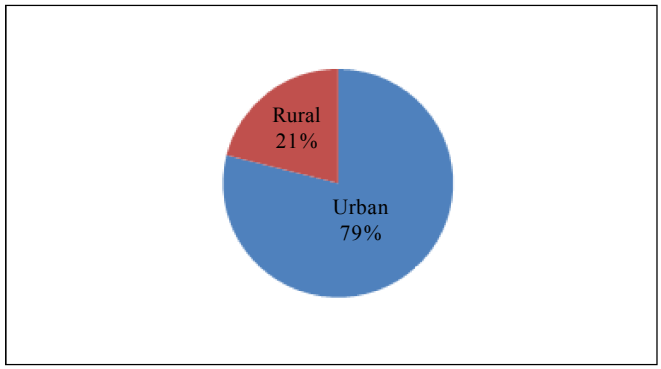

Figure 4: Incidence of SCD based on Locality

(50%) (Figure 6, Table 6). Other high risk factors when taken into consideration such as diabetes mellitus and hypertension, 16 cases (42.10%) were found to be hypertensive and 12 cases (31.57%) diabetics (Figure 7, Table 7). A careful observation was made on the time of onset of terminal symptoms and death. It was noted that majority of the victims, that is 18 cases (47.36%) died within 6-12 hours of onset of terminal symptoms in the present study, followed by 8 cases (21.06%) who died within 12-18 hours of onset of terminal symptoms (Figure 8, Table 8). Majority of the victims (20 cases, 52.63%) died at home followed by 11 victims (28.94%) who died at work place. Most of the victims (30 cases, 78.94%) died during sleep, followed by 5 victims (13.15%) who died during routine non-strenuous activity and 3 victims

Table 5: Incidence of sudden cardiac deaths based on diet

Diet	No. of cases	Percentage (%)
Mixed	28	73.68
Vegetarian	10	26.32
Total	**38**	**100**

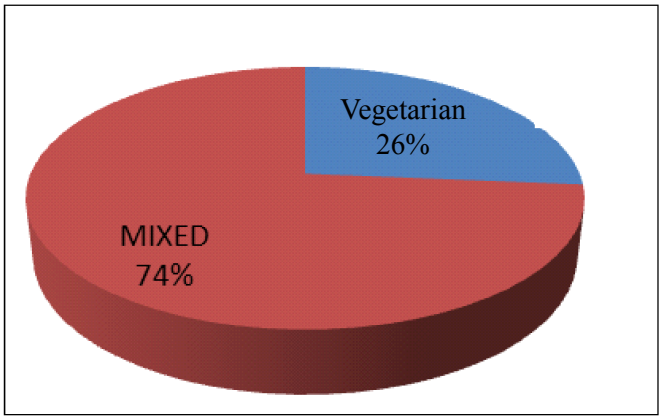

Figure 5: Incidence of SCD based on Diet

Table 6: Incidence of sudden cardiac deaths based on personal habits

Personal habits	No. of cases	Percentage (%)
Smoking	19	50
Alcoholism	19	50
Total	**38**	**100**

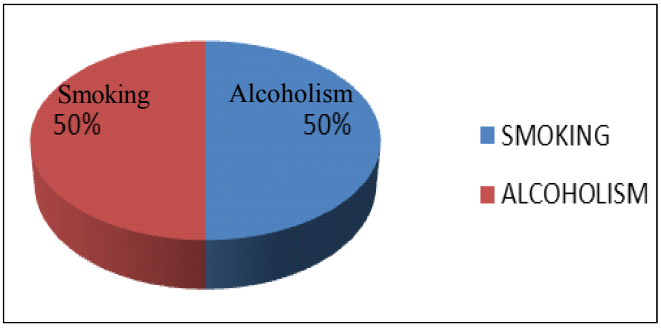

Figure 6: Incidence of SCD based on Personal Habits

Table 7: Role of diabetes and hypertension in relation to sudden cardiac deaths

Role	No. of cases	Percentage (%)
Diabetes	12	31.57
Hypertension	16	42.10
Both	10	26.32
Total	**38**	**100**

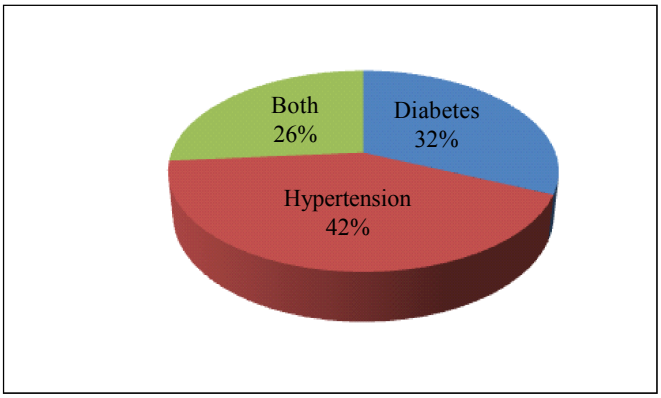

Figure 7: Role of Diabetes and Hypertension in SCD

Table 8: Time of onset of terminal symptoms in relation with SCD

Time period (hours)	No. of cases	Percentage (%)
0-6	2	5.26
6-12	18	47.36
12-18	8	21.06
18-24	5	13.15
Not known	5	13.15
Total	**38**	**100**

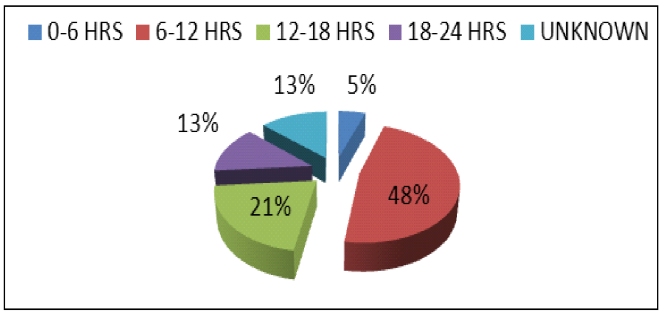

Figure 8: Time of Onset of Terminal Symptoms

during strenuous activity. Majority of the victims (24 deaths, 63.15%) died as a result of occlusive coronary artery disease, and 6 deaths (15.78%) were due to myocardial infarction (Figure 9, Table 9).

DISCUSSION

The comparison of published autopsy study on SCDs is difficult because studies vary respectively in their definition of SCD, in their inclusion criteria of gender and age, demographic profile and in the causes of death analysed. However, a decent attempt has been made to compare with the already existing autopsy studies on

Table 9: Incidence of sudden cardiac deaths based on aetiological classification

Disease	No. of cases	Percentage (%)
Occlusive coronary artery disease	24	63.15
Acute myocardial infarction	6	15.78
Ruptured ascending aortic aneurysm	1	2.63
Valvular heart diseases	1	2.63
Hypertrophic cardiomyopathies	2	5.26
Thrombi in the right side of the heart	1	2.63
Endocarditis	1	2.63
Pericarditis	1	2.63
Cardiac tamponade	1	2.63
Total	**38**	**100**

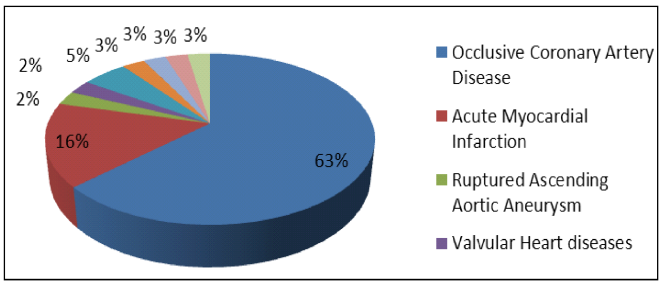

Figure 9: Incidence of SCD based on Aetiological Classification

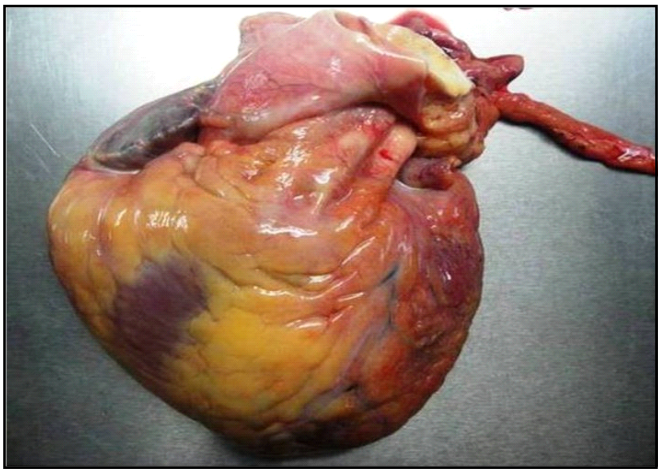

Figure 10: Grossly enlarged heart weighing 535 grams

Figure 11: Pericardial effusion with dilatation of right atrium

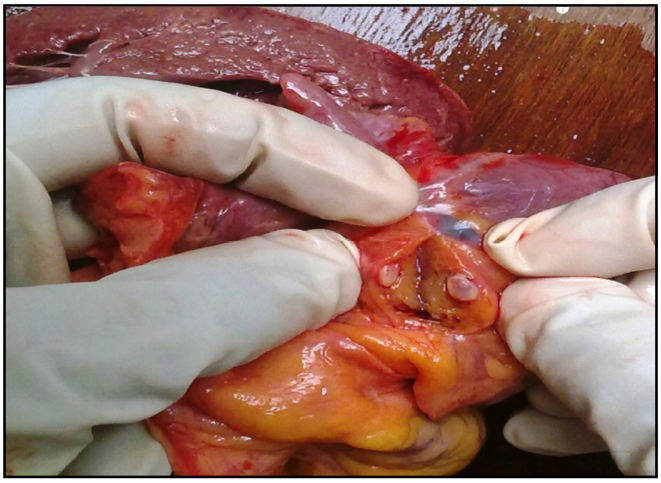

Figure 12: 95% occlusion in left anterior descending coronary artery

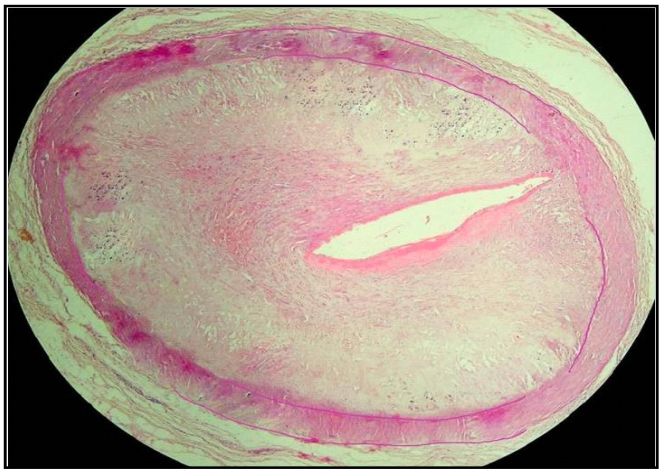

Figure 13: Microscopy of LAD showing 90-95% luminal occlusion

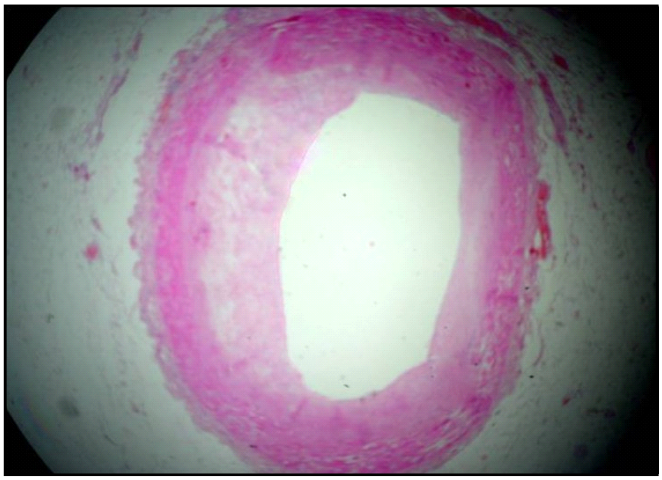

Figure 14: Microscopy of LAD showing 30-40% luminal occlusion

sudden cardiac deaths. In our study of SCD, majority of the victims belonged to the age group of 41-50 years, which correlates with the findings of Naneix *et al.*[8] and Chugh *et al.*[9]. The incidence of SCD increases with age because the prevalence of cardiac ischemia increases with age[10]. In this autopsy series, males constituted 92.1% of the total victims and females constituted 7.9% of the total victims. This male dominance in relation to SCD correlates with many studies, including that of Naneix *et al*. and Chugh *et al*., up to the age range of 40-50 years. However, it defers from the study by Rizzo *et al*. who observed that it high in females above 80 years due to menopause-related coronary atherosclerosis. Majority of the victims in our study died at home and during sleep

or resting. This correlates with majority of the studies once again, such as Naneix *et al.*, Penttila[11], de la Grandmaison[12] and Pochmalicki *et al.*[13]. Considering residence, 30 (78.9%) were from urban, while the remaining 8 (21.06%) had rural background. Going with socioeconomic status 18 (47.36%) were from the middle-class society. These findings correlate with the study done by Hygriv Rao *et al.*[14]. In their study, 49% of the study population were hypertensive and 35.5% were diabetics, whereas our study showed 42% hypertensive and 26% diabetics, which is also correlative. However, in the study done by Hygriv Rao *et al*., only smoking as a risk factor for SCD was taken into consideration excluding alcoholism and studied population comprised of 39.8% whereas in our study both smoking and alcoholism were taken into consideration which showed that 50% of the population were smokers and 50% were alcoholics. In our study the time interval between the onset of symptoms and the death was 6-12 hours in majority of the victims (47.36%), whereas in most of the studies it was 1 hour. This disparity could be due to the small sample size which was studied and more importantly due to the presence of relatives at home who hospitalised the victims early. Our study correlates with most studies made on SCD in relationship with the aetiology and showed that 63.15% of the studied population succumbed to occlusive coronary artery disease with coronary atherosclerosis leading the table.

CONCLUSION

In India, SCD contributes to 10.3% of overall mortality. In our study 38 cases of sudden cardiac death were dealt with a systematic autopsy protocol including histological examination. Our observations mainly suggest that males run a more risk for SCD. Also, the risk factors associated with SCD are consistent with all previous studies made by different authorities. In this era of westernised society the younger population runs the major risk factors for SCD. This knowledge helps us to take appropriate measures time to time to keep the public aware and prevent premature deaths and thereby promoting a healthy lifestyle.

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