

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

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Abstract

Many cases of sudden unexpected natural deaths occur in individuals without known medical diseases. Sudden natural deaths continue to be an important worldwide public health problem. The incidence of sudden natural deaths and causes vary in different societies, and these differences are influenced by many demographic factors. In this study among the 88 Sudden deaths, 64%, 24%, 10% and 2 % were due to cardiovascular, respiratory, central nervous system and gastro-intestinal system causes respectively. Males dominated females with a death sex ratio of 2.26:1. Maximum number of the victims belonged to 41-50 years age group. Majority of the victims died due to occlusive CAD. Maximum period of survival after onset of terminal symptoms was less than 1 hour.

Keywords: Sudden natural death, sudden death, unexpected death, Coronary artery disease, Autopsy, pathology.

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Introduction:

It is quite possible for a person to be in apparently perfect health but at the same time suffering from a serious disease of which he may not be aware. Sudden deaths are important from a medico legal standpoint as they may raise suspicion of foul play.¹ Death is said to be sudden or unexpected in a person not known to have been suffering from any dangerous disease, injury or poisoning is found dead or dies within 24 hours after the onset of terminal illness.² Natural death means the death occurring due to natural disease or pathological condition, old age, debility or devitalization. Death that

occurs within one minute of the onset of symptoms has been regarded as "instantaneous" death. Sudden death is not necessarily unexpected and unexpected death is not necessarily sudden, but very often the two combinations coexist. The more unexpected the death, the more likely it is to be unexplained.

Every unexpected death has an actual or potential medico legal aspect; such deaths come under the scrutiny of medico legal investigative official. Medical interest lies in accurate establishment of cause and manner of death in these unanticipated fatalities and also in those in which violence of some type is known or alleged to have played a part. Legal importance derives from the availability and utilization of precise and objective medical data for the administration of justice, whether it is a civil action for wrongful death, workmen's compensation,

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insurance benefit or a criminal prosecution for some of homicide.³

Commonly, medico legal autopsies are conducted in cases of sudden and unexpected deaths primarily to establish the cause of death in cases where such deaths have occurred in apparently healthy individuals under suspicious circumstances. The outcome may quite often reveal some natural disease, the presence of which may trigger issues like association of the disease with trauma, work, crime, etc., and its relative contribution towards death. The association of disease with trauma may have criminal aspect or may involve compensation benefits for the relatives. The situation may become very knotty where the trauma per se is not fatal and pathological lesion found at autopsy may have been compatible with continued life like chronic heart disease and these can create difficulties in determining the cause of death.⁴ Such death may occur during emotional excitement, mental tension, and strenuous physical work or simply while resting or sleeping in the bed. When the death occurs without the presence of other persons, suspicion of homicidal death has to be clarified. Precipitating factor may be a blow or a fall. In such cases, a medical practitioner should not certify the cause of death without holding the post-mortem examination, even if there is strong evidence of disease. Often after autopsy, unnatural death may turn out to be natural and vice versa.⁵

Several studies have shown that cardiovascular disease was the most important cause of the sudden natural death. It was followed by respiratory disease, central nervous system disease and others. Several factors such as age, sex, occupation and marital status may also influence the sudden natural death which were evaluated in this study. Natural deaths undoubtedly constitute a significant portion of deaths which undergo autopsy for investigation of death. Therefore, the

study of autopsies of individuals dying of sudden deaths was undertaken.

Materials and Methods:

A prospective autopsy study of sudden natural death cases which was conducted at Kempegowda Institute of Medical Sciences and Hospital (KIMS), Bangalore, Karnataka, India for a period of 18 months from January 2011 to July 2012 formed the primary material of the study. The objectives were to assess the frequency, describe the demographic profile and to assess the causes of sudden deaths among the autopsies conducted. 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 site of death by the police for post-mortem examination, help of the investigating officer was sought to know the manner of death.

Using Letuelle's evisceration technique, the organs were carefully removed and examined by weighing and further dissecting them. The whole organs in some cases and pieces of each organ in some cases, showing gross pathologic changes were preserved in 10% formalin and were subjected to histopathological examination. Whenever possible discussions were held with the clinicians who had treated the deceased persons in hospital admitted cases. In few cases viscera was preserved for chemical analysis to rule out poisoning.

After receiving the histopathology and chemical analysis report, final opinion as to cause of death was given. Data was collected and analysed statistically using appropriate statistical tools (namely Microsoft Excel 2007 and IBM SPSS V.20) with respect to age, sex, personal habits like, smoking, alcohol consumption, socio

economic status, place, activity at the time and cause of death.

Results and Observations:

During this study period, 760 cases were brought for medico legal autopsies out of which 88 (11.5%) cases were sudden deaths. Out of the 88 cases, sudden cardiac deaths accounted for 63.6% of total deaths, 21 deaths (23.8%) accounted for sudden deaths due to respiratory diseases, sudden deaths due to central nervous system pathology and gastrointestinal tract pathology accounted for 10.2 % and 2.27 % of total deaths respectively [Table 1]. Among the 88 sudden deaths, maximum number of deaths (37.5%) were observed in the age group of 41-50 years [Table 2]. Males dominated females in number of deaths with a death sex ratio M:F ::2.26:1.

Table 1: System wise distribution of sudden natural deaths.

System	Frequency	%
Cardiovascular system	56	63.6
Respiratory system	21	23.8
Central nervous system	9	10.2
Gastrointestinal tract	2	2.27
Total	88	100

Table 2: Age wise distribution of sudden natural deaths.

Age Group (In years)	Frequency	%
11 to 20	3	3.4
21 to 30	10	11.36
31 to 40	21	23.86
41 to 50	33	37.5
51 to 60	9	10.22
61 to 70	6	6.81
71 to 80	3	3.40
81 to 90	3	3.40
Total	88	100

Majority of the deceased persons (32.95%) were skilled labourers. About 82 % of the victims were from urban areas of Bangalore.

Maximum deaths were observed in populations belonging to the middle socioeconomic class (51%). Most of the deceased persons (78%) adhered to a mixed diet. Majority of the victims (51%) were found dead at home. While analysing the activity of the deceased persons at the time of death we observed that most of the victims (45%) died while resting.

Table 3: Incidence of SND based on Etiological classification.

Classification	Frequency	%
Cardiovascular System		
Occlusive CAD	40	45.46
Acute Myocardial infarction	6	6.81
Ruptured Ascending aorta	1	1.13
Valvular heart diseases	1	1.13
Hypertrophic cardiomyopathy	2	2.27
Thrombi in right side of heart	1	1.13
Endocarditis	1	1.13
Pericarditis	1	1.13
Cardiac tamponade	1	1.13
Respiratory System		
Bronchopneumonia	21	23.86
Bronchial Asthma	1	1.13
Pulmonary Tuberculosis	3	3.4
Bronchiolitis	1	1.13
Central Nervous System		
Sub-arachnoid hemorrhage	2	2.27
Epilepsy	2	2.27
Superior sagittal venous thrombosis	1	1.13
Intracerebral Haemorrhage	1	1.13
Gastro Intestinal Tract -		
Alcoholic Hepatitis	2	2.27
Total	88	100

While further correlating personal habits and chronic illnesses known to be high risk

factors for sudden deaths such as smoking, alcoholism, drug abuse, diabetes and hypertension we observed that 66% of the total study population were substance abusers and 30% were suffering from diabetes and hypertension. Maximum number of deaths were due to occlusive coronary artery disease and accounted for 45% of total deaths compared to other causes [Table 3]. The maximum period of survival after onset of terminal symptoms in most of the cases was less than 1 hour (41%) [Table 4].

Table 4: Period of Survival after onset of Terminal symptoms.

Period of Survival	Frequency	%
Found dead	30	34.09
0 – 1 hr	36	40.9
1-6 hrs	5	5.7
6-24 hrs	17	19.31
Total	88	100

Discussion:

The definition of sudden death varies according to the authority and convention. No universally accepted standard interval from onset of terminal symptoms to cessation of heartbeat and respiration defines death as sudden. For research purposes, that interval has been variously defined at 0, 1, 2, 6, and 24 hours^{6,7}. WHO defines sudden death as —Death that is unknown or sudden and occurring within 24 hours from onset of symptomsl.

In the present study, it has been observed that incidence of sudden natural death was 88 cases out of 760 total deaths (11.57%) amongst the medico legal autopsies conducted during the study period. SND rates in forensic series from other studies were similar to this study, such as; 8.92% in Zanjad et al,⁸ 8.67% in Rao et al,⁹ 15.48% in Ambade V.N.¹⁰ In contrast, high SND rates in forensic autopsy series were reported as 55.6% in Obiorah C.C et al,¹¹ 51.3% in Escoffery and Shirley,¹² 27.8% in Nordrum et al,¹³ 28.9% in Derya A.A¹⁴ and 31.4% in Kuller

et al.¹⁵ In the present study, most of the cases (28.3%) belonged to 41 to 50 years age group. This correlates with the similar findings made by kumar et al and Sarkioja et al^{16,17}. But it does not correlate with the observations made by Zanjad et al and Ambade VN. This may be due to urbanization, westernization of Indian society, sedentary life style, tobacco smoking, alcohol, stress and lack of regular medical check-ups.

In our study, 61 cases were males and 27 cases were females with male to female ratio of 2.26:1. The same observation was made by Thomas AC et al¹⁸. However Sarkioja et al observed a M:F ratio to be as high as 5:1. In both the cases males outnumbered females. During reproductive life, women for reason still unknown are remarkably spared unless they have an underlying predisposition to atherosclerosis such as diabetes mellitus and hypertension. Also, habits of smoking and alcoholism are common in males and may contribute to high incidence of SND in them.

Workers in industries, mills, shops, farms and other sectors constituted highest number of cases. This correlates with study of Kumar et al where majority of the patients were from the semiskilled–unskilled group. The preponderance in this group is possibly due to low socio-economic status, neglect of alarming symptoms of illness, unaffordable treatment, physical and mental stress.

We observed most of the victims were from urban area. The preponderance to urban area could be because KIMS hospital is located in the heart of the Bangalore city and serves the urban population of south Bangalore.

We observed that most of the sudden deaths occurred at home and while resting. The same finding was also made by Kuller et al and Fornes et al.^{19,20} Incidence of sudden natural deaths based on food habits showed that majority of deaths were non-vegetarians which depicts that concentration of fatty acids can contribute to increased risk of

cardio vascular diseases leading to sudden natural deaths.

More than half of the studied population were smokers and alcoholics. Heavy smoking was most common in SND in a study done by Rissanen V, which is consistent with the present study. However, an association between smoking and SND was not found in a study by Madhavan SR et al²¹ as these habits might have been underreported due to social taboos.

Diabetes and hypertension were present in 30% of total population. Diabetes increases risk of coronary artery disease, a condition that is commonly found in association with sudden natural death. However, there may be diabetes specific accelerated forms of atherosclerosis with enhanced thrombogenicity. Hypertension is associated with the majority of cases of cerebrovascular accident and congestive cardiac failure in a study by Escoffery and Shirley. The important goal of preventing sudden death however will be heavily dependent on enhancement of risk stratification techniques. Therefore discovery of novel risk stratification markers and methods has become the top priority in the field of sudden death investigation.

In the present series of study, maximum deaths were related to diseases of cardiovascular system. Similar observations were made by several researchers such as Nandy A, Reddy KSN and Zanjad et al. Preponderance to cardiovascular system could be explained by changing social concepts and way of living, physical and mental stress, food habits- high concentration of fatty foods, high salt intake, ice-cream, bakery items, lack of exercise with sedentary lifestyle, urbanization, industrialization and progressive excessive indulgence of younger age groups in predisposing factors like smoking, alcoholism and drug addiction. Regarding deaths related to the cardiovascular system, ischemic heart disease (IHD) and myocardial infarction (MI) were the most common causes of

sudden natural death. Similar findings were made by Sarkioja et al, Nordrum et al, Thomas AC et al and Rao et al. This depicts that coronary artery disease was the most important cause not only among deaths due to cardiovascular causes but also among sudden deaths. However Escoffery and Shirley found in only 7% of all sudden natural deaths in forensic autopsy cases. In our study most of the victims died within 1 hour of onset of terminal symptoms. This correlates with the findings made by Rissanen V and Thomas A.C.

Conclusion:

Overall this study reveals the following

1. The incidence of sudden natural deaths among the total medico legal autopsies performed was 11.6%
2. Adults between the ages of 41-50 years are most vulnerable to sudden deaths.
3. Males dominated females in our study with a death sex ratio of 2.26:1.
4. More common among people from Middle socioeconomic class.
5. Smokers, alcoholics, diabetics and hypertensive's are at a greater risk.
6. Occlusive coronary artery disease was found to be the main cause of sudden death.
7. Maximum Period of Survival after onset of terminal symptoms was less than 1 hour.

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