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An autopsy study of sudden natural deaths conducted at Govt hospital

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Abstract

Background: Many cases of sudden unexpected natural deaths occur in individuals without known medical diseases. Sudden natural death (SND) remains 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.

Objectives: To assess the frequency of sudden natural deaths among the autopsies, study the demographic profile and causes for sudden natural deaths.

Methods: The study period was from 1st January 2015 to 31st July 2017 during which 760 autopsies were conducted, out of which, 88 cases were sudden natural deaths. Among them 60 cases of sudden natural deaths were selected for the study based on purposive sampling.

Results: Incidence of sudden natural death was 11.57% out of all autopsies. The maximum number of cases (28.3%) was in the age group of 41-50 years, males constituting 81.7%. Out of 60 cases, more than half of the deaths (63.3%) accounted from cardiovascular diseases, 23.3% were due to respiratory diseases, 10% due to central nervous system diseases and 3.3% due to gastrointestinal diseases. Majority were Hindus (86.6%), belonged to urban area (83.3%), married (83.3%) and 81.7% were found in people taking mixed diet. In more than half of the cases (53.3%) death took place when the deceased was in his/her residence while resting. More than half of the cases were smokers and alcoholics with 51.7% and 58.3% respectively; drug abuse was seen in 2 cases (3.3%). Diabetes was seen in 11 cases (18.3%) and Hypertension in 15 cases (25%). 41.7% were found dead and 33.3% were brought dead to the hospital. Workers in industries, mills, shops, farms and other sectors constituted 16 cases (26.7%).

Conclusion: Cardiovascular system pathologies especially coronary artery diseases remain the leading cause of sudden natural deaths in this study. Respiratory system diseases contributed the next major share of diseases. There is clear influence of age, sex, occupation, marital status, food habits, socio-economic status, co-morbid conditions, smoking and alcoholism on the incidence of sudden natural death.

Keywords: sudden natural death; autopsy; cardiovascular system; coronary artery disease; coronary artery occlusion; medico legal case

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 medicolegal 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 medicolegal 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, 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].

Earlier 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 will be evaluated during this research.

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 death is undertaken.

Objectives

To assess the frequency of sudden natural deaths among the autopsies conducted at GGH hospital, Vijayawada.

To describe the demographic profile of sudden natural deaths.

To assess the causes for sudden natural deaths.

Material and Methods

Source of Data

Department of Forensic Medicine, Govt Hospital, Vijayawada, conducts autopsies of sudden, suspicious and unnatural deaths which occur in and around Vijayawada. The present study is an Observational study of sudden natural death cases which were autopsied at Govt hospital, for a period of 1½ years from 1st January 2015 to July 2017 which form the material of the study.

Ethical Clearance

Ethical clearance for the present study was obtained from the institutions ethical committee, Govt Siddhartha Medical College, Vijayawada.

Method of collection of data

All cases with history of sudden natural deaths autopsied at Govt medical College, Vijayawada were included in the study. These include

1. Cases that were brought dead to hospital, or the cases where the death was unobserved / unattended and were brought to our institution for post-mortem examination with the manner of death either natural or not known and the cause of which subsequently on post-mortem examination turned out to be sudden and natural.
2. Cases that were admitted to a hospital and died within 24 hours of onset of signs & symptoms then brought to our hospital for post-mortem examination.
3. 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.
4. In cases where the death was unobserved / unattended and the dead body was brought directly from site of death by police for post-mortem examination, help of police investigating officer was taken to know the manner of death.
5. Detailed autopsy was performed using the Lettulle's evisceration technique, examining and taking weight of all organs before dissection. Gross examination of the organs was performed and each individual organ was dissected as per the standard autopsy technique.
6. The whole organs or pieces of organs showing gross pathologic changes were preserved for histopathology examination in 10% formalin solution and were forwarded to Pathology department after taking consent from the relatives. Materials for bacteriological analysis were sent when needed. Discussion was held with the clinicians who have treated the deceased person in admitted cases. In few cases viscera was preserved for chemical analysis to rule out poisoning.
7. After the receipt of histopathology report and chemical analysis report, final opinion as to cause of death was given. Data was collected and analyzed statistically with respect to age, sex, personal habits like smoking, alcohol consumption, drug intake, diseases like diabetes & hypertension, socio economic status, marital status, occupation, time, place & deceased activity at the time of incident and cause of death.

Inclusion Criteria

1. All cases of sudden natural deaths brought to Govt hospital mortuary.

Exclusion Criteria

1. Autopsy on unidentified bodies.
2. Autopsy on decomposed bodies.
3. Autopsy on sudden natural deaths associated with injury, poisoning and any other suspected foul play.

Sample Size: 60 cases

Statistical Methods: The data collected in this study was analyzed statistically using descriptive statistics like mean and percentages.

Results

The present study was carried out in the Department of Forensic Medicine from 1st January 2015 to 31st July 2017. During this period, 760 autopsies were conducted, out of which, 88 cases (11.57%) were sudden natural deaths. 60

cases of sudden natural deaths were selected for the study based on purposive sampling.

Following observations were made.

Table 1: Age wise distribution of sudden natural deaths

Age group in years	No. of cases	Percentage
11-20	3	5
21-30	10	16.7
31-40	14	23.3
41-50	17	28.3
51-60	9	15
61-70	3	5
71-80	3	5
81-90	1	1.7
Total	60	100

In the present study, it was observed that majority (17 cases/ 28.3%) of the sudden natural deaths were in the age group of 41-50 years followed by 14 (23.3%) cases in the age group 31-40 years and least (1.7%) were in the age group of 81-90 years. No cases were observed in the age group less than 10 years. Age range was from 11 to 85 years.

Table 2: Sex wise incidence of sudden natural deaths

Sex	No. of cases	Percentage
Male	49	81.7
Female	11	18.3
Total	60	100

In the present study, it was observed that majority (49 cases/81.7%) of the sudden natural deaths was seen among males and 11 cases (18.3%) were seen in females. The male to female ratio was 4.46:1.

Table 3: Incidence of sudden natural deaths based on religion

Religion	No. of cases	Percentage
Hindus	52	86.6
Muslims	4	6.7
Christians	3	5
Jain	1	1.7
Total	60	100

In the present study it was observed that majority of the cases (52 cases / 86.7%) of sudden natural deaths were Hindus by religion followed by 4 (6.7%) Muslim, 3 (5%) Christians, and only one case that belonged to the Jain religion.

Table 4: Occupation wise distribution of sudden natural deaths

Occupation	No. of cases	Percentage
Not applicable (<18 years / student)	3	5
Office / Private employees	9	15
Business	8	13.3
Labourer	11	18.3
Worker in industries, mills, shops, farm, & other sectors	16	26.7
Housewife	6	10
Driver	4	6.7
Unemployed	3	5
Total	60	100

In the present study, it was observed that workers in industries, mills, shops, farms and other sectors constituted 16 cases (26.7%), followed by Labourers 11 cases (18.3%). Office workers / private employees constituted 9 cases (15%), businessmen 8 cases (13.3%), housewives 6 cases (10%), drivers 4 cases (6.7%). Students and unemployed constituted minimum number of cases (3 cases each).

Table 5: Incidence of sudden natural deaths based on locality

Locality	No. of cases	Percentage
Urban	50	83.3
Rural	10	16.7
Total	60	100

In this study majority of the victims (50 cases / 83.3%) were from urban area, the victim from rural area were only 10 (16.7%).

Table 6: Incidence of sudden natural deaths based on marital status

Marital status	No. of cases	Percentage
Married	50	83.3
Un-married	10	16.7
Total	60	100

In the present study it was observed that 50 (83.3%) victims were married and 10 (16.7%) were unmarried.

Table 7: Incidence of sudden natural deaths based on food habits

Food habits	No. of cases	Percentage
Vegetarian diet	11	18.3
Mixed diet	49	81.7
Total	60	100

The above table shows the incidence of sudden natural deaths based on food habits. Majority of cases of SND (49 cases/81.7%) were found in people taking mixed diet, remaining 11 cases (18.3%) were vegetarians.

Table 8: Incidence of sudden natural deaths based on socio-economic class

Socio-economic class	No. of cases	Percentage
Lower class	26	43.3
Middle class	28	46.7
Upper class	6	10
Total	60	100

In the present study it was observed that 26 (43.3%) victims belonged to lower socio-economical class, 28 (46.7%) belonged to middle class followed by upper class constituting 6 cases (10%).

Table 9: Place of occurrence of sudden natural deaths

Place of death	No. of cases	Percentage
Home	32	53.3
Work place	11	18.3
Public place	7	11.7
Road side	4	6.7
Hospital	6	10
Total	60	100

In the present study most of the cases of sudden natural deaths, i.e. 32 cases (53.3%) took place when the deceased was at home. 11(18.3%) deaths took place at work place, 7 (11.7%) deaths in public place, 4 (6.7%) deaths at road side and 6 (10%) deaths in hospital while on treatment.

Table 10: Activity of deceased at the time of death

Activity	No. of cases	Percentage
Resting	30	50
Routine activity	19	31.7
Strenuous activity	8	13.3
Not known	3	5
Total	60	100

In the present study, half of the cases of sudden natural deaths, i.e. 30 cases took place when the deceased was at rest, 19 deaths (31.7%) took place while doing routine day today work, 8 deaths (13.3%) during strenuous activity. In 3 cases (5%) the activity of deceased at the time of death was not known.

Table 11: Personal habits in relation to sudden natural deaths

Sl. No	Habits	Yes		No	
		No. of cases	%	No. of cases	%
1	Smoking	31	51.7	29	48.3
2	Alcoholism	35	58.3	25	41.7
3	Drug abuse	2	3.3	58	96.7

In present study it was observed that the persons having habit of smoking, alcoholism and drug abuse outnumbered those not having any habit. Almost morethan half of the cases were smokers and alcoholics with 31 cases (51.7%) and 35 cases (58.3%) respectively. Drug abuse was seen in 2 cases (3.3%).

Table 12: Diabetes and hypertension in relation to sudden natural death

Sl. No		Present		Absent		Not known	
		No of cases	%	No of cases	%	No of cases	%
1	Diabetes	12	20	37	61.7	11	18.3
2	Hypertension	15	25	38	63.3	7	11.7

In the present study, 12 (20%) were known cases of diabetes, 37 (61.7%) were non diabetic and in 11 cases (18.3%) history of diabetes was not known. Hypertension was seen in 15 cases (25%), absent in 38 cases (63.3%) and not known in 7 cases (11.7%).

Table 13: Time of onset of symptoms

Time period (hours)	No. of cases	Percentage
0 - 6	2	3.3
6 - 12	21	35
12 - 18	17	28.3
18 - 24	15	25
Not known	5	8.3
Total	60	100

In this study, the time of onset of symptoms was between 06 hours to 12 hours in 21 (35%) cases, followed by the 12 hours to 18 hours in 17 (28.3%) cases, 18 hours to 24 hours in 15 (25%) cases. The least number of cases (3.3%) were seen in 00 hours to 06 hours. Time of onset of symptoms was not known in 5 (8.3%) deaths.

Table 14: System wise distribution of sudden natural deaths

System	Frequency	Percentage
Diseases of Cardiovascular system	38	63.3
Diseases of Respiratory system	14	23.3
Diseases of Central nervous system	6	10
Diseases of Gastrointestinal system	2	3.3
Total	60	100

Among 60 cases, the majority of the sudden natural deaths (63%) were due to the diseases of cardiovascular system, followed by deaths due to diseases of respiratory system accounting to 23.3%. The diseases of Central nervous system constituted 10% and gastro intestinal system 3.3%.

Table 15: Incidence of sudden natural deaths based on aetiological classification

Classification	No. of cases	Percentage
Diseases of Cardiovascular System		
Occlusive coronary artery diseases	24	40
Acute myocardial infarction	6	10
Ruptured ascending aortic aneurysm	1	1.7
Valvular heart diseases	1	1.7
Hypertrophic cardiomyopathies	2	3.3
Thrombi in right side of heart	1	1.7
Endocarditis	1	1.7
Pericarditis	1	1.7
Cardiac tamponade	1	1.7
Diseases of Respiratory System		
Bronchopneumonia	9	15
Asthma	1	1.7
Pulmonary Tuberculosis	3	5
Bronchiolitis	1	1.7
Diseases of Central Nervous System		
Subarachnoid haemorrhage	2	3.3
Epilepsy	2	3.3
Superior sagital venous thrombosis	1	1.7
Intracerebral haemorrhage	1	1.7
Diseases of Gastro Intestinal System		
Alcoholic hepatitis	2	3.3
Total	60	100

Table 16: period of survival after the onset of symptoms

Period of survival	No. of cases	Percentage
Found dead	25	41.7
Brought dead/ 0-1 hour	20	33.3
1-6 hours	2	3.3
6-24 hours	13	21.7
Total	60	100

The above table represents the incidence of sudden natural deaths according to the period of survival from the onset of symptoms. In this series, 25 cases (41.7%) were found dead elsewhere, 20 cases (33.3%) died within 0-1 hour and presented with history of brought dead to the hospital. Only 2 cases (3.3%) died within 1-6 hours and 13 cases (21.3%) within 6-24 hours after the onset of symptoms.



Fig 1: Photograph 3 - Left anterior descending coronary artery showing patent

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 symptoms".

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], Nandy^[11] and Reddy K.S.N² also show the incidence as approximately 10% of all deaths. In contrast, high SND rates in forensic autopsy series were reported as 55.6% in Obiorah C.C *et al.*^[12], 51.3% in Escoffery and Shirley^[13], 27.8% in Nordrum *et al.*^[14], 28.9% in Derya A.A^[15], and 31.4% in Kuller *et al.*^[19]. Variation is due to different autopsy centres having different type of case load, different geographical areas and different constitution and life styles of people.

As shown in the table no 1, in the age distribution for the present study, most of the cases (28.3%) belonged to 41 to 50 years age group and the minimum (1.7%) belonged to 81-90 years. Kumar *et al.*^[18] showed the largest number of sudden natural death in the age group of 41-50 years.

From all the above studies, it was observed that the maximum number of sudden deaths were seen in the middle aged (31 to 50 years), which is consistent with the present study. It may be due to urbanization, westernization of Indian society, sedentary life style, increased smoking habit and alcohol, stress and strain in life and lack of regular medical check-up. In contrast, sudden deaths were most prevalent in the 50-59 years age group in Derya A.A^[15] and 61-70 years age group in Escoffery and Shirley^[13] which is not consistent with present study.

In the present study, out of 60 total sudden deaths, 49 cases (81.7%) were male and 11 cases (18.3%) were female with male to female ratio 4.46:1. The study of Sarkioja *et al.*^[16] showed, out of 77 cases of sudden unexpected death, 63 (82%) were male and 14 (18%) were female with male to female ratio 4.5:1. The study of Thomas A.C *et al.*^[17] shows that, out of 322 cases of sudden natural deaths, 238 (73.9%) were male and 84 (26%) were female and male to female ratio was 2.83:1. The study of Nordrum *et al.*^[14] showed that, out of 428 cases, 341 (79.67%) were male and 87 (20.32%) were female with male to female ratio 3.91:1.

It was observed that most of the victims were Hindus with 52 (86.6%) cases followed by Muslims with 4 (6.7%) cases, Christians with 3 (5%) cases and only one case of a deceased who belonged to the Jain religion (1.7%). These percentages roughly correspond with the percentages of religion in general population. Hence, religion has no bearing on sudden natural death.

Workers in industries, mills, shops, farms and other sectors constituted highest number of cases i.e. 16 (26.7%), followed by 11 cases of labourers (18.3%). It coincides with study of Kumar *et al.*^[18] where majority of the patients were from the semiskilled-unskilled group (30.6%). 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 etc.

Almost all cases were from middle and lower socio-economic class constituting 90% which comprises labourers, workers in industries, mills, shops, farms and other sectors, drivers and so on. These groups basically have lower income compared to higher class. Due to financial problem, they might not get regular medical checkups for early detection of their diseases or even treatment for their diseases. Risk factors for coronary artery disease such as lack of physical activity, smoking, hyperlipidemia, hypertension, obesity, and diabetes are more common among individuals with lower socio-economic status. Higher socio-economic class contributed least to the sudden natural deaths (10%) which comprises businessmen, office or private employs, managers and executives. They had better knowledge and were more aware of the health importance. Their economic status also allowed them to have a better nutrition and healthier lifestyle.

In this study most of the victims (83.3%) were from urban area. It is observed that most of the sudden deaths occurred at home i.e. 32 cases (53.3%), followed by workplace in 11 cases (18.3%), public place in 7 cases (11.7%), road side in 4 cases (6.7%) and hospital in 6 cases (10%). Half of the cases of sudden natural deaths, i.e. 30 cases took place when the deceased were at rest, 31.7% of deaths took place while doing routine day today work (eating, speaking, walking, etc.). This means majority of sudden deaths took place when the deceased were resting in his/her home.

Present study is consistent with Kuller *et al.*^[19], the place of onset of symptoms was home in home in 62.4% of cases

Incidence of sudden natural deaths based on food habits showed that majority of deaths were non vegetarians constituting 49 cases (81.7%), which depicts that concentration of fatty acids can contribute to increased risk of cardio vascular diseases leading to sudden natural deaths.

Almost more than half of the cases were smokers and alcoholics with 51.7% and 58.3% respectively. Heavy smoking was most common in SND in a study done by Rissanen V⁷ which is consistent with the present study.

In the present series of study, maximum deaths were related to diseases of cardiovascular system constituting 38 cases (63.4%). 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.

Similar rates of cardio vascular diseases have been reported as 56.4% by Di Maio and Di Maio^[20].

In the present study, it has been observed that recent myocardial infarction was seen in 6 (20%) cases of coronary artery disease. Recent myocardial infarction was confirmed by histopathological examination. Farb *et al.*^[21] examined 90 hearts, acute MI was present in 19 cases (21%).

Out of 60 cases, 25 (41.7%) were found dead in which period of survival was not known. 20 (33.3%) cases died within 1 hour of onset of symptoms and were brought dead to the hospital, 2 (3.3%) cases died within 1- 6 hours and 13 (21.7%) cases died within 6-24 hours of onset of terminal illness. It coincides with study by Rissanen V⁷ and Thomas

A.C⁶³ in which about half of the patients died within an hour of onset of symptoms.

Conclusion

From this study we can conclude that diseases of the cardiovascular system are the major contributing factor for sudden natural deaths. Among the diseases of cardiovascular system, coronary artery disease is the major contributing factor. The age distribution curve points out the fact that younger age group involvement appears to be slightly higher. Sudden natural deaths were associated with treatable coronary risks such as hypertension and diabetes. Aggressive risk factor modification in this population may favourably affect sudden cardiac death related mortality. Respiratory system diseases contributed the next major share of diseases. This can be attributed to poor hygiene, malnutrition and low socio-economic status. This type of autopsy based information is vital in the planning of the health services, teaching and research programmes, particularly in a developing nation with a limited resource. Even under circumstances suggestive of foul play one need to bear in mind the possibility of sudden natural death and thereby emphasize the medicolegal importance of sudden natural death. Thus an unbiased open mind when investigating medicolegal cases helps to serve the justice to the best. Meticulous postmortem and histopathological examination are needed to minimize risk of autopsy being negative or obscure one.

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Conflict of Interest

Nil

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