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RESEARCH ARTICLE

Pattern of Occurrence in Cases of Sudden Natural Deaths - A Retrospective Study

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Abstract

Introduction: Sudden death is said to be sudden or unexpected when the victim not known to have been suffering from any dangerous disease, injury or poisoning is found dead or dies within 24 hours of the onset of terminal illness (WHO). Incidences of sudden natural deaths are increasing now a days and specifically in healthy young individuals. Our study may help to provide epidemiological data regarding the sudden death so that appropriate action can be made to reduce the morbidity and mortality. **Aim:** This retrospective study was undertaken to analyse the pattern of occurrence in cases of sudden natural deaths autopsied at Mortuary, Government Rajaji Hospital, Madurai. **Materials and Methods:** This retrospective study had been conducted for the period of one year on the autopsy cases brought to Mortuary, Government Rajaji Hospital, Madurai. During study period total of 4110 autopsies were conducted, out of which 224 cases (6%) were sudden deaths. **Result:** Most of the cases were from the 41-50 years age group. Of the 224 cases, 119 cases were due to diseases of cardiovascular system and 43 cases were due to diseases of respiratory system. **Conclusion:** We observed that sudden death cases were higher in younger age group and cardiovascular system was most commonly involved.

Keywords: Autopsy, Cardiovascular System, Sudden Natural Death

1. Introduction

All forensic pathologists deal not only with suspicious, accidental and suicidal deaths, but with a wide range of deaths due to natural causes. Death is said to be sudden, if death occurs in less than 24 hours from the onset of signs and symptoms, not otherwise explained, death known not to be violent or instantaneous in nature for which no cause can be discovered[1]. Some authors limit sudden deaths as those occurring instantaneously or within one hour of onset of signs and symptoms[2].

An apparently healthy individual of any age, when dies suddenly and unexpectedly without any pre indication or even in case of natural death under suspicious state and possibility of any disease being responsible for it being considered as remote, any suspicion of foul play, injury, poisoning may arise in the mind of medical officers responsible for the certification of death[3].

Determination of cause of death in natural deaths is an important part of forensic autopsy practice for the following reasons[4]:

- Performance of a complete autopsy on apparent natural deaths can provide valuable information like identifying public health risks and monitoring disease trends in the interest of public health.
- Identification of disease processes and patterns provide epidemiological data that can be used for controlling disease outbreaks, identifying changes in disease patterns, or to identify reportable diseases.
- The timely and accurate diagnosis of medically important diseases can have a significant impact on the relatives of the deceased by allowing them to seek treatment for certain hereditary diseases.

Earlier studies have shown that cardiovascular system was the most important cause of the sudden death. It was

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followed by respiratory system, central nervous system and others. Several factors such as age, sex, occupation, marital status and lifestyle may also influence the sudden death which will be evaluated during this research.

2. Aim

This retrospective study was undertaken to analyse the pattern of occurrence in cases of sudden natural deaths autopsied at Mortuary, Government Rajaji Hospital, Madurai.

3. Materials and Methods

This retrospective study was done in the Department of Forensic Medicine and Toxicology, Madurai Medical College and Government Rajaji Hospital, Madurai. Cases were taken from January 2023 to December 2023 for one year. During this one year period 4110 autopsies were conducted and out of them 224 cases (6%) of sudden death were selected for present study.

The information regarding the circumstances of death with special reference to any signs and symptoms suggestive of sudden death, family history, previous medical history were taken from inquest papers. Histopathology and chemical analysis reports in all cases were included in this study, which provided valuable insights into the study's outcomes.Findings of this study were compared with the similar studies done by the Indian and foreign authors.

3.1 Inclusion Criteria

All cases of sudden natural death.

3.2 Exclusion Criteria

- All cases where death occurred due to injury or poisoning.
- All cases where the victim dies after 24 hours from the onset of signs and symptoms.
- Decomposed cases.
- Unidentified cases.

4. Review of Literature

Sudden natural death is a significant public health concern, accounting for 10-20 % of all deaths worldwide. Sudden natural death refers to unexpected, non-traumatic fatalities occurring within minutes or hours of onset, often without warning signs. Understanding the aetiology, risk factors and pathological features is crucial for accurate diagnosis, prevention, and management. Cardiovascular diseases (50-70 %) are the leading cause of sudden natural death, followed by respiratory conditions (10-20 %), gastrointestinal system (5-15 %) and neurological disorders (5-10 %).

Hypertension, coronary artery disease, cardiomyopathy and stroke are common underlying conditions. Respiratory causes include chronic obstructive pulmonary disease, pneumonia, and pulmonary embolism. Middle-aged and elderly individuals, males, and those with pre-existing medical conditions are at higher risk. Lifestyle factors such as smoking, obesity, physical inactivity and poor diet contribute significantly. Family history, ethnicity, and socioeconomic status also play a role.

During pathological examination, diseases like myocardial infarction, hypertensive heart disease, cerebral oedema, haemorrhage, pulmonary embolism and pneumonia are frequent found. Autopsy findings, toxicology and biochemistry analysis, and histopathological examination are essential for accurate diagnosis.

Forensic experts must consider the circumstances surrounding death, medical history and scene investigation. Early detection and treatment of underlying conditions, lifestyle modifications and optimizing emergency medical services are critical. Public awareness campaigns, screening programs and healthcare access improvement can reduce sudden natural death incidence.

Sudden natural death poses significant challenges in forensic medicine and public health. Understanding the complex interplay of etiological factors, risk factors and pathological features is crucial for accurate diagnosis, prevention, and management. Continued research and collaboration among healthcare professionals, researchers and policymakers are essential to reduce sudden natural death incidence.

5. Results

Table 1 shows distribution of sudden death cases according to the age and sex in which majority of cases

were in the age group 41-50 years (27.23 %) and 31-40 years (25.01%). Males were affected more (84.79%) when compared to females (15.21%) making M/F ratio of 5.57:1.

Table 2 and Figure 1 shows distribution of sudden death cases according to their marital status, in which majority of the cases were married (77.23%) and 14.73% cases were unmarried.

Table 3 shows distribution of sudden death cases according to their occupation, in which workers in industries, mills, shops, farms and other sectors contributed 20.09%, Office/Private Employee contributed 17.41% and followed by Government Employee 16.52%.

Table 4 shows distribution of sudden death cases according to their life style, in which cases with sedentary and moderate work life style cases completely outnumbered cases with heavy work life style.

Table 5 and Figure 2 showing distribution of sudden death cases according to involvement of body system in which majority of the sudden deaths were due to the diseases of cardiovascular system (53.12%) followed by diseases of respiratory system (19%).

Table 6 shows distribution of sudden death cases according to the activity of deceased in which 41.96% victims while doing routine day work and 37.50% were at rest at the time of onset of symptoms.

Table 7 shows individual system wise distribution of cause of death in sudden death cases, in which acute myocardial infarction (60.5%) is the leading cause of sudden natural death in cardiovascular system.

Table 1. Distribution of sudden death cases according to the age and sex

Age Group	Male (%)	Female (%)	Total (%)
1-10	2(0.89)	1(0.45)	3(1.34)
11-20	2(0.89)	3(1.34)	5(2.23)
21-30	14(6.24)	7(3.13)	21(9.37)
31-40	52(23.22)	4(1.79)	56(25.01)
41-50	56(24.99)	5(2.24)	61(27.23)
51-60	42(18.74)	4(1.79)	46(20.53)
Above 60	22(9.82)	10(4.47)	32(14.29)
Total	190(84.79)	34(15.21)	224(100)

Table 2. Distribution of sudden death cases according to their marital status

Marital Status	No. of cases	Percentage
Unmarried	33	14.73
Married	173	77.23
Divorced	4	1.79
Widow/widower	14	6.25
Total	224	100

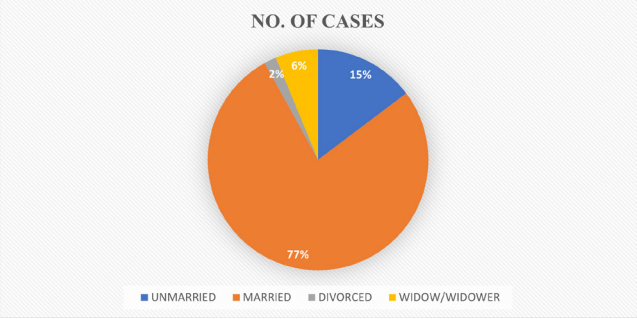

Figure 1. Distribution of sudden death cases according to their marital status.

Table 3. Distribution of sudden death cases according to their occupation

Occupation	No. of cases	Percentage
Not applicable (<18 years and student)	10	4.46
Office / Private Employee	39	17.41
Business person	20	8.93
Labourer	20	8.93
Worker in industries, mills, shops, farm and other sectors	45	20.09
Housewife	19	8.48
Unemployed	7	3.13
Government Employee	37	16.52
Retired person	27	12.05
Total	224	100

Table 4. Distribution of sudden death cases according to their life style

Life style	No. of cases	Percentage
Sedentary	96	42.85
Moderate work	104	46.43
Heavy work	24	10.72
Total	224	100

Table 5. Distribution of sudden death cases according to involvement of body system

System	No. of cases	Percentage
Cardiovascular	119	53.12
Respiratory	43	19.19
Gastrointestinal	25	11.16
Central nervous	17	7.5
Genitourinary	4	1.7
Miscellaneous	16	7.14
Total	224	100

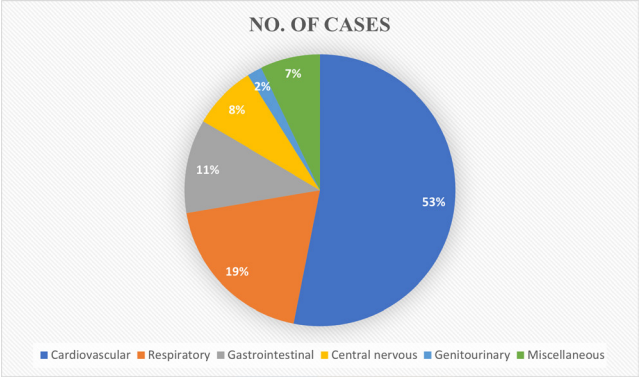

Figure 2. Distribution of sudden death cases according to involvement of body system

Table 6. Distribution of sudden death cases according to activity of deceased at the time of onset of symptoms

Activity	No. of cases	Percentage
Not known	10	4.47
Rest	84	37.5
Routine activity	94	41.96
Strenuous activity	8	3.57
Sleeping	17	7.59
Travelling	11	4.91
Total	224	100

6. Discussion

During the one-year period, 4110 medico-legal autopsies were conducted and out of them incidence of sudden natural death was 224 (6%) cases. Almost similar incidence was noticed in the studies done by Reddy[2], Nandy[5], Rao *et al.*, (8.67%)[6], Zanjad *et al.*, (8.92%)[7], Ambade et al., (15.48%)[8]. In contrast, higher incidence of sudden death was reported by most of the foreign authors e.g., Obiorah *et al.*, (55.6%)[9], in

Table 7. Individual system wise distribution of cause of death

System involved	Number of cases	System wise %
Cardiovascular system	**119**	
Acute myocardial infarction	72	60.5%
Coronary artery disease	20	16.8%
Coronary artery anomalies	5	4.2%
Cardiac arrhythmia	10	8.4%
Cardiomyopathy	12	10.08%
Respiratory system	**43**	
Lobar pneumonia	22	51.16%
Pulmonary TB	3	6.97%
Pulmonary embolism	6	13.95%
Bronchial asthma	11	25.58%
Pneumothorax	1	2.32%
Gastrointestinal system	**25**	
Fatty liver	10	40%
Cirrhosis	9	36%
Acute haemorrhagic pancreatitis	1	4%
Chemical peritonitis	2	8%
Oesophageal varices	3	12%
Central nervous system	**17**	
Intracerebral haemorrhage	9	52.94%
Subarachnoid haemorrhage	5	29.41%
Epilepsy	2	11.76%
Berry aneurysm	1	5.88%

Escoffery and Shirley *et al.*, (51.3%)[10], Kuller *et al.*, (31.4%)[11], Azmak *et al.*, (28.9%)[12], and Nordrum *et al.*, (27.8%)[13]. Higher incidence of sudden death may be due to different type of case load, geographical location and life styles of people.

Table 1 shows the distribution of cases according to their age and sex. Maximum number of the victims

(27.2%) belonged to the age group of 41-50 years which was also observed by Kumar *et al.*,[14] and Sarkioja *et al.*,[15] While Zanjad *et al.,* (26.78%)[7] and Ambade *et al.*, (20.75%)[8] found maximum cases in the age group of 31-40 years.

Most of the studies done in India are showing that the maximum numbers of sudden death occur in the middle-aged people (31-50 years). It may be due to rapid urbanization, westernization of Indian society, sedentary life style, increase in the smoking habits, stressful job/life, lack of adequate sleep, lack of regular exercise and lack of regular medical check-up.

In our study, majority of the victims (84.79%) were male and 15.21% were female making male to female ratio of 5.57:1 which was also observed in similarly studies done by Zanjad *et al.*,[7], Kumar *et al.*,[14] and Rao *et al.*,[6]. Thus from above studies, it was evident that males are more prone to sudden death than females, which is consistent with our present study. Women belonging to the reproductive age group remarkably spared, but reason is still unknown. Unless they have an underlying predisposition to atherosclerosis such as diabetes mellitus and hypertension, women are not affected by sudden death. Habits of smoking and alcoholism are more common in males and males are more prone to stressful situations as compared to females.

In our study, most of the victims (77.23%) were married, as the frequency of occurrence of sudden natural deaths increases with aging. This coincides with studies done by Gupta *et al.*, (63.49%)[17] and Kumar *et al.*, (59.8%)[14] where majority of the sudden deaths were seen in married individuals. The reason may be married people are more worried about their financial and other social issues.

In our study, most of the cases were from middle and lower socio-economic class constituting 90.18% which comprised of manual labourers, workers in the industries, mills, shops, farms and other sectors. Since, these groups have lower income when compared to higher class, they do not get regular medical checkups for early detection or even for treatment. Risk factors for coronary artery disease such as smoking, alcoholism, hyperlipidaemia, hypertension, obesity, lack of physical activity and diabetes are more common among individuals with middle socio-economic status. Higher socio-economic class contributed least to the sudden deaths (9.82%) which comprised of businessmen, managers and executives. They had better knowledge and more aware of importance of the health. Also, their economic status allows them to have a better nutrition and healthier lifestyle.

Table 3 shows that workers in industries, mills, shops, farms and other sectors constituted highest number cases (20.09%) and labourers (8.9%). It coincides with study by Kumar *et al.*, (30.6%)[14] where majority of the victims belong to semiskilled–unskilled group. The preponderance in this group is possibly due to lower socio-economic status, lower education, neglect of alarming symptoms of the disease, unaffordable treatment and physical stress etc.

We observed that maximum number of deaths were related to diseases of cardiovascular system constituting about 53.12% which was very well supported by similar other studies e.g., Di Maio and Di Maio *et al.*, (60.9%)[18], Puranik *et al.*, (56.4%)[16], Azmak *et al.*, (55%)[12], Anderson *et al.*, (53.4%)[19], 45-50 % by Reddy[2] and 45% by Nandy[5]. Preponderance could be explained by changing social concepts, way of living, change in food habits like taking more fatty foods, high salt intake and eating bakery items, physical stress, mental stress, lack of exercise, sedentary lifestyle, urbanization, industrialization and in younger age groups predisposing factors like smoking and alcoholism. In contrast to our study, very high incidence of cardiovascular disease rates was reported by Lorin *et al.*, (72.7%)[20] and Sarkioja *et al.,* (83%)[15]. However, much lower rates of cardiovascular diseases were also reported by Obiorah *et al.*, (23%)[9]. Acute myocardial infarction (60.5%) is the leading cause of sudden natural death in cardiovascular system.

The second most common cause of sudden natural death was related to diseases of respiratory system 19.19% which very well supported in study done by Yadhukul *et al.*, (27.45%)[6] and Escoffery and Shirley *et al.*, (23%)[10]. Lung disease may be difficult to accept as a cause of sudden death, but intermittent hypoxia may lead to ventricular arrhythmias in these patients. Pneumonia constituted about 51.16% of all respiratory deaths which was similar to study by Nordrum *et al.*, (52.8%)[13] and Obiorah *et al.*, (62.6%)[9]. The high rate of death due to pneumonia is attributable to a lack of proper education, lack of adequate health care, exposure to the

cold and inadequate nutrition. Sudden deaths due to pulmonary tuberculosis were 6.97% which were more when compared to study done by Azmak *et al.*, (0.7%)[12] and Kumar *et al.*, (3.1%)[14]. Lower socioeconomic status, social stigma and treatment default were the reason for higher incidence of pulmonary tuberculosis in our study.

The third commonest cause of sudden natural death was related to diseases of GI system (11.16%) which is consistent with study done by Chaudhari *et al.*, (11.3%)[21]. Fatty liver (40%) was the commonest cause and it is followed by cirrhosis (36%). The fourth commonest cause of sudden death was related to diseases of central nervous system (7.5%) which was almost similar to study done by Chaudhari *et al*[21]. Intracerebral haemorrhage (52.94%) was the commonest cause and it is followed by subarachnoid haemorrhage (29.41%).

7. Conclusion

This study shows influence of age, gender, occupation, marital status, socio-economic class and life style on the incidence of sudden natural death. From our study, we can conclude that diseases of the cardiovascular system are the major cause for sudden deaths. The age distribution points out that involvement of younger age group appears to be slightly higher. Respiratory system diseases were the next major contributor of sudden death and this can be attributed to poor hygiene, lack of proper education and treatment, malnutrition and lower socioeconomic status. This study helps in planning of the health services, teaching and research programmes, particularly in a development of nation with a limited resource.

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