

# Sudden Natural Death: A Retrospective 10-Year Review of Postmortem Cases in a Tertiary Care Hospital

Anya Mirium Abraham<sup>1</sup>, Nagesh K.R.<sup>2</sup>

## How to cite this article:

Anya Mirium Abraham, Nagesh K.R. Sudden Natural Death: A Retrospective 10-Year Review of Postmortem Cases in a Tertiary Care Hospital. Indian J Forensic Med Pathol.2024;17(3):201-206.

## Abstract

**Background:** Sudden death in an apparently healthy individual usually arises suspicion among the public. In such cases, autopsies help to ascertain the exact cause of death and thereby assist the investigating officer in disposing the case.

**Objectives:** To determine the incidence, sex and age wise distribution, causes of death in sudden natural deaths reported in the study centre, and to correlate the postmortem and histopathology findings in these cases.

**Methodology:** Sudden natural death cases autopsied over 10 years from January 2012 to December 2022 were studied retrospectively.

**Results:** About 93 cases of suddennatural death cases were autopsied during the study period. The age of the study sample was ranged from 15-80 years with 86% male prevalence. In majority of the cases, the cause of death was due to cardiovascular diseases (76.3%), followed by cerebrovascular diseases (8.6%), gastrointestinal diseases (8.6%), respiratory diseases (4.28%) and genitourinary diseases (2.14%). The autopsy and histopathology findings helped to ascertain the causes of death.

**Conclusion:**Autopsy in sudden death cases helps to ascertain the cause of death and thereby help to resolve the suspicious cases.

**Keywords:** Sudden natural death; sudden death; cardiac death; respiratory causes of death; gastrointestinal causes of death.

## INTRODUCTION

Sudden death is defined by the World Health Organization (WHO) as “death occurring within 24 hours after onset of symptoms”.<sup>1</sup> Usually the sudden natural death cases are related to cardiovascular, respiratory, neurological, gastrointestinal, infective and genitourinary diseases.<sup>2</sup> Comorbidities including hypertension and diabetes mellitus, advanced age, low or high body mass index (BMI), smoking, unhealthy diet

**Author's Credentials:** <sup>1</sup>Principal Investigator, <sup>2</sup>Guide & Co-investigator, Department of Forensic Medicine, Father Muller Medical College, Mangalore 575002, Karnataka, India.

**Corresponding Author:** Nagesh K.R., Guide & Co-investigator, Department of Forensic Medicine, Father Muller Medical College, Mangalore 575002, Karnataka, India.

**Email:** [nageshkr@fathermuller.in](mailto:nageshkr@fathermuller.in)

**Received on:** 10-01-2024

**Accepted on:** 16-10-2024



and sedentary habits have all been established as risk factors for the sudden death.<sup>3</sup>

Majority of the incidence of sudden natural deaths are seen in adults above 40 years of age.<sup>4,5</sup> However, it is not uncommon to see the sudden natural deaths in young adults less than 40 years of age.<sup>6,7</sup> Moreover, the lack of medical records of pre-existing natural disease conditions, it will be difficult to certify the cause of death clinically. All these factors cause lots of confusion among the relatives and public, thereby usually raises suspicion on death of such young adults.

Although the incidence and documentation of sudden deaths vary in different parts of the world, likely due to differences in death registration and medico legal autopsy systems, it is pivotal to conduct autopsies to ascertain the exact cause of death and the nature of the origin of the macroscopic and microscopic findings.<sup>8</sup>

In the present study, we review the postmortem records with objectives of determining the incidence, age and sex-wise distribution, and causes of death in sudden natural death cases reported in the study centre, and to correlate the postmortem and histopathological findings in these cases.

## METHODOLOGY

A retrospective autopsy-based review of sudden

natural death cases that were autopsied in the Department of Forensic Medicine, Father Muller Medical College Hospital, Mangalore was carried out. Autopsies conducted over 10 years from January 2012 to December 2022 were included in the study after obtaining permission from the Institutional Ethics Committee.

Cases of homicide, suicide and traumatic accidental deaths, and cases without the histopathology reports were excluded from the study.

The records of all the sudden natural deaths autopsied in the study period were studied after necessary permissions, and analysed the various factors such as age and sex of the deceased, cause of death, pertinent comorbidities and other relevant laboratory findings. The histopathological findings were reviewed and correlated with the corresponding postmortem findings. The data was entered in an Excel spreadsheet, and the variables will be reported as frequencies and percentage.

## RESULTS

About 93 sudden natural death cases fulfilled the inclusion criteria of the present study. There were 74 males (79.5%) and 19 females (20.4%) with an M:F ratio of 3.9:1. The age of the study sample ranged from 15-80 years with the mean age being  $52 \pm 15$  years (Fig. 1 and Table 1).

About 73 (78.4%) of the cases were above the age

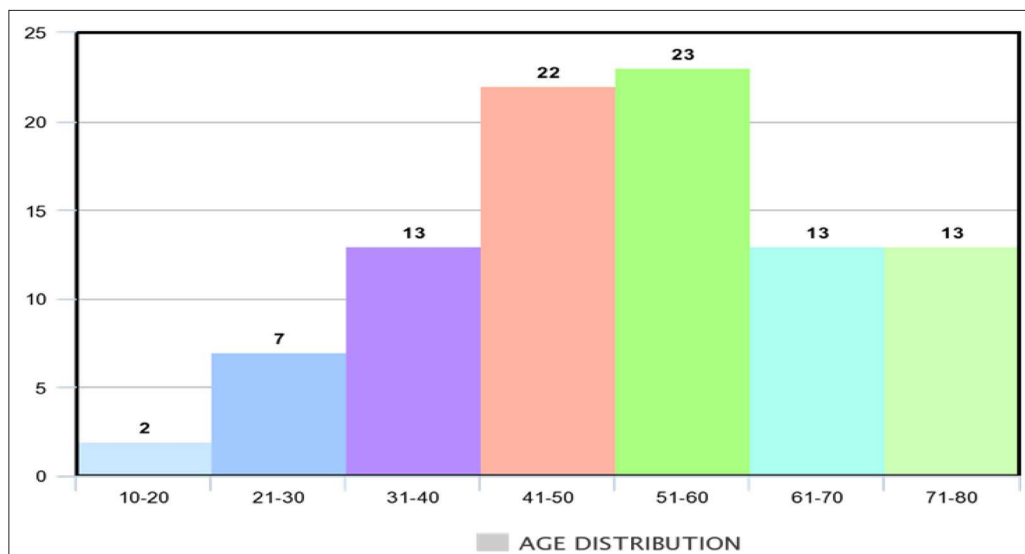


Fig. 1: Age-wise distribution of study sample

of 40 years. Male preponderance was seen in all age groups except the adolescent group, which showed a slightly higher female prevalence.

The system-wise cause of death distribution of cases is shown in Fig. 2 and Table 2. The most commonly involved organ system was the cardiovascular system (71 cases, 76.3%), of which 86% of the cases were seen

in males and 14% in females. Among the cardiovascular cases, the age of the study sample ranged from 18-80 years with a mean age of  $54 \pm 13.6$  years. The highest frequency of cardiovascular cases was seen between 40-75 years of age (85.9%). The cause of death in most cases was attributed to coronary artery disease (CAD) accounting for 90.14% of the total cardiovascular deaths and 68.8% of the total sudden natural deaths. About 14% of the sudden natural death cases were associated with triple vessel block by an atherosclerotic plaque involving the left anterior descending artery, left circumflex artery and right coronary artery, while 26.5%

and 35.9% involved double and single vessel block, respectively. The remaining vessels, although associated with atherosclerosis and calcifications, were patent (23.6%). The most commonly involved artery was the left anterior descending artery with 35.9% of the total sudden natural death cases involving a 90-100% block of the same. The other observed causes of cardiovascular deaths included dissecting aneurysm of the aorta, heart failure secondary to cardiac tamponade, valvular heart disease and ventricular fibrillation (1.07% each).

Other systems involved were the central nervous

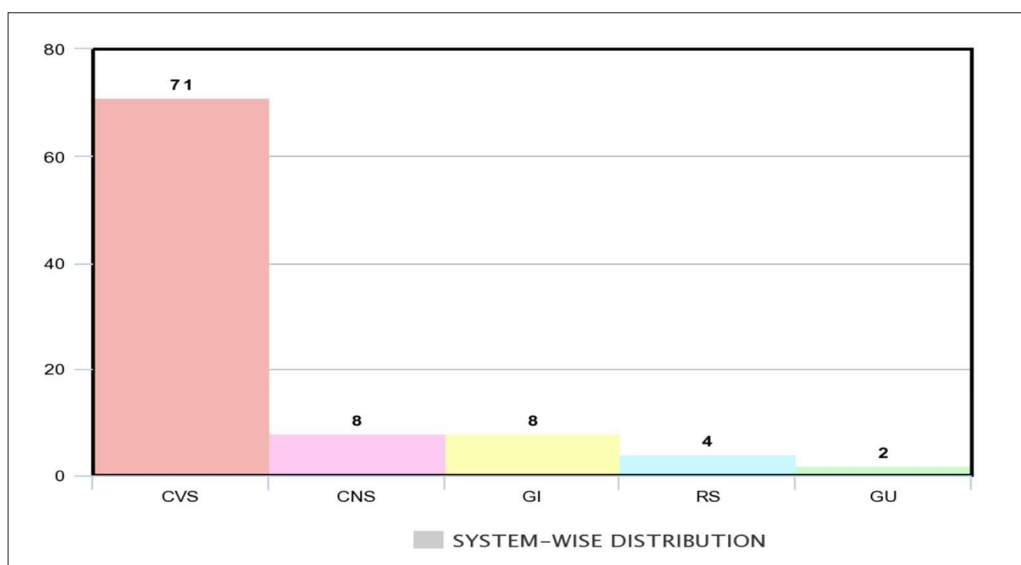


Fig. 2: Cause of death distribution in study sample

system (8.6%) and the gastrointestinal system (8.6%). The most common cause of death involving the CNS was spontaneous intracranial haemorrhage, causing 7.5% of the total deaths. A single case of death due to epilepsy was seen. The most common gastrointestinal cause of death was due to acute pancreatitis (6.4%), with other causes being intestinal infarction, septicemia due to amyloidosis, and haemorrhage due to infective gastritis and infective colitis (1.07% each). Of the total cases, the respiratory system consists of 4.28% cases, with pneumonia, lung carcinoma, pulmonary tuberculosis and pulmonary thromboembolism being observed (1.07% each). The genitourinary system involved the least number of cases (2.14%), with rupture of the uterus and ruptured ectopic pregnancy seen (1.07% each).

The most common autopsy and histopathology findings related to the respiratory system included pulmonary oedema, intra-alveolar haemorrhage, pneumonia and emphysema, while oedema and intracranial haemorrhage were commonly observed in

the cerebrovascular cases. Renal findings majorly included acute tubular necrosis and chronic pyelonephritis, in addition to the findings of renal cysts, haemorrhage and amyloidosis. Liver findings commonly included hepatic necrosis, steatosis, steatohepatitis and cirrhotic changes. Mucosal oedema, haemorrhage and pancreatic necrosis were seen in gastrointestinal deaths.

Table 1: Age and sex-wise distribution of study sample

Age (yrs)	Male (%)	Female (%)
10-20	0 (0%)	2 (100%)
21-30	4 (57.1%)	3 (42.9%)
31-40	11 (84.6%)	2 (15.4%)
41-50	19 (86.3%)	3 (13.7%)
51-60	20 (87%)	3 (13%)
61-70	12 (92.3%)	1 (7.7%)
71-80	8 (61.5%)	5 (38.5%)

**Table 2:** System-wise distribution of study sample

System	Male (%)	Female (%)
CVS	60 (84.5%)	11 (15.5%)
CNS	5 (62.5%)	3 (37.5%)
GI	5 (62.5%)	3 (37.5%)
RS	4 (100%)	0 (0%)
GU	0 (0%)	2 (100%)

## DISCUSSION

Sudden natural death is established as an important circumstance in forensic medicine due to its ambiguous clinical course and short symptomatic period, which interfere with the investigations into the cause and circumstances of death. The occurrence of sudden natural death is closely tied to the inability of the healthcare system to screen and identify risk factors for cardiovascular, respiratory, gastrointestinal and cerebrovascular diseases, likely due to systemic bias and economic inequality of the lower socioeconomic classes. Developing countries have a lack of infrastructure and healthcare facilities that make it difficult to adequately screen for comorbidities or assure a high quality of care at the time of onset of disease.

A total of 93 sudden natural death autopsied cases were reported from the tertiary care centre in the 10-year study period. About 86% of the total deaths occurred in males, which is in concurrence with other studies where it is established that males present a higher risk of sudden natural death, possibly due to the higher incidence of cardiovascular disease.<sup>1-3</sup>

In the present study, the age of the study population varied from 15-80 years with a mean age of  $52 \pm 15$  years, and an immense number of cases occurring in the ages of 45-70 years representing 85.9% of the study population. This is consistent with many other studies, demonstrating an increased risk of sudden natural death beyond the age of 40 years.<sup>4,5,9</sup> This could be due to reason of increased incidence of comorbid conditions in elderly people such as hypertension, coronary heart disease, systolic dysfunction and congestive heart failure, which can later involve all systems of the body.<sup>10,11</sup>

Cardiovascular deaths (76.3%) formed the majority of sudden natural deaths in the present study. Of these, 86% cases were males and 14% were females. Similar findings were observed in previous studies that have established a male preponderance in cardiovascular

cases.<sup>12,13</sup> Coronary artery disease accounted for 90.14% of the total cardiovascular deaths and 68.8% of the total sudden natural deaths, which is in concurrence with other studies.<sup>5,14</sup> The other causes of cardiovascular deaths involved include dissecting aneurysm of the aorta, heart failure secondary to cardiac tamponade, valvular heart disease and ventricular fibrillation (1.07% each), which have been observed as a cause of death in multiple studies.<sup>4,12</sup>

In the present study, triple vessel block (left anterior descending artery, left circumflex artery and right coronary artery) was seen in 14% of the total sudden natural deaths, while double and single vessel block was seen in 26.5% and 35.9% of the total cases, respectively. The left anterior descending artery was the most commonly involved vessel (35.9% of cases) involving 90-100% block, followed by the left circumflex and right coronary arteries.

Multiple studies have established the involvement of the left anterior descending artery in cases of death due to coronary artery disease.<sup>4,15-17</sup>

The risk factors include higher dietary intake of saturated fats, urbanization, lack of exercise and a sedentary lifestyle, cigarette smoking and comorbidities like hypertension, diabetes mellitus and dyslipidemias. Increased urbanization leading to exposure to physical and mental stressors also plays a role in the pathogenesis of cardiac deaths. Smoking, alcoholism and substance abuse are also linked to the increased risk of death due to cardiovascular disease, highlighting the need for extensive clinical and laboratory investigations for the early detection of risk factors.<sup>18</sup>

In the present study, the second most commonly involved system was the central nervous system and the gastrointestinal system, with 8.6% of the total deaths each. This is in contrast to some studies that establish the respiratory system as the second most commonly involved system.<sup>1,2,3</sup> This could be attributed to the smaller sample size present in the hospital where the study was conducted, regional variation of sudden natural deaths due to differences in lifestyle and food habits, and racial differences.

The commonly involved diseases in cerebrovascular deaths include spontaneous intracranial haemorrhage (7.5%) and epilepsy (1.07%). The involved haemorrhagic or infarcted vessels are identified during autopsy and histopathology. The incidence of intracranial haemorrhage could be closely linked to coronary artery disease and hypertension, as well as smoking and alcohol abuse since almost all the involved cerebrovascular deaths had findings of

atherosclerosis with calcification or plaques blocking the coronaries or left ventricular hypertrophy.

Gastrointestinal deaths involved acute pancreatitis (6.4%), intestinal infarction (1.07%), septicemia due to amyloidosis (1.07%), and haemorrhage due to infective gastritis and infective colitis (1.07%). These are common causes of death observed in multiple reviews conducted worldwide.<sup>8,19</sup> They involved mucosal oedema and haemorrhage involving the pancreas, stomach, small intestine and large intestine. Splenic congestion was involved in almost all cases and the liver findings included hepatic necrosis, steatosis, steatohepatitis and cirrhotic changes.

The next most commonly involved system was the respiratory system, which accounted for 4.28% of the total cases, which contradicts multiple studies which establish this system as the second most commonly involved.<sup>1,3,8</sup> A lack of study samples could explain this trend, as well as regional or racial differences in the South. Causes of death in this system include pneumonia (1.07%), lung carcinoma (1.07%), pulmonary tuberculosis (1.07%) and pulmonary thromboembolism (1.07%). Autopsy and histopathology findings in these deaths involved pulmonary oedema, intra-alveolar haemorrhage, consolidation and emphysematous changes. Respiratory deaths can be attributed to lower socioeconomic conditions in the developing Indian subcontinent, with poor sanitary conditions, malnutrition, an increased prevalence of tuberculosis, and a lower quality of healthcare that fails to prevent and address these issues. Genitourinary cases accounted for the least number of deaths (2.14%), with one death occurring due to rupture of the uterus (1.07%) and another due to ruptured ectopic pregnancy (1.07%).

Common findings in autopsy and histopathology reports in cardiovascular deaths include atherosclerosis with calcification and plaques in the coronaries as well as large vessels, left ventricular hypertrophy, fibrosis and calcification of heart valves, scarring due to previous myocardial infarction, as well as block in the left anterior descending, left circumflex and right coronaries.

Pulmonary oedema, intraalveolar haemorrhage, pneumonia and emphysema are seen in respiratory related deaths, while cerebral oedema and intracranial haemorrhage were observed in the cerebrovascular cases. Renal findings included acute tubular necrosis and chronic pyelonephritis, in addition to renal cysts, haemorrhage and amyloidosis. Liver findings included hepatic necrosis, steatosis, steatohepatitis and cirrhotic changes while mucosal oedema, haemorrhage and pancreatic necrosis were seen in gastrointestinal deaths.

Haemorrhage and rupture of the uterus and ovarian cysts were seen in multiple cases. These findings follow the common trend of changes occurring in sudden natural deaths.<sup>8,9</sup>

## CONCLUSION

During a 10-year study period, 93 cases of sudden natural death were reported, between the ages of 15-80 years, with 86% male prevalence. The maximum cases were due to cardiovascular disease (76.3%), followed by cerebrovascular (8.6%) and gastrointestinal involvement (8.6%), and respiratory (4.28%) and genitourinary system (2.14%). Pathologies involving the cardiovascular system, especially coronary artery disease (68.8%), remain the leading cause of death in this study. Preexisting conditions must be properly screened and diagnosed so that a huge number of these deaths can be prevented with early identification of symptoms and timely intervention.

### Acknowledgement

I would like to thank Head of department of Forensic Medicine, Father Muller Medical College for giving permission to assess the data required for this project, and the Father Muller Research Centre for their support in completing this project.

**Funding Details:** None

**Conflict of Interest:** None

## REFERENCES

- Pelemo OE, Sabageh D, Komolafe AO.** *et al.* An autopsy review of sudden unexpected natural deaths in a suburban Nigerian population. *Popul Health Metrics.* 2014; 12: 26.
- Ugiagbe EE, Ugiagbe RA.** Causes of sudden natural death: a medico-legal autopsy study of medical cases in an African referral centre. *East Afr Med J.* 2012; 89(10): 332-338.
- Daş T, Buğra A.** Natural Causes of Sudden Young Adult Deaths in Forensic Autopsies. *Cureus.* 2022; 14(2): e21856.
- Zipes DP, Wellens HJ.** Sudden cardiac death. *Circulation.* 1998; 98(21): 2334-2351.
- Mittal G, Menon A, Krishan M, Nambiar S, UnniKrishan B, Kanchan T.** Analysis of sudden deaths in a coastal region of South India. *Indian Journal of Medical Specialities.* 2014; 5(1): 20-22.
- KR Nagesh, Rastogi P, Pai MR.** Sudden cardiac death due to myocarditis – review

- with a case report. *J Forensic Med Toxicol.* 2009; 26 (1): 14-18.
7. **Drory Y, Turetz Y, Hiss Y, et al.** Sudden unexpected death in persons less than 40 years of age. *Am J Cardiol.* 1991; 68: 1388-1392.
  8. **Sessa F, Esposito M, Messina G, Di Mizio G, Di Nunno N, Salerno M.** Sudden Death in Adults: A Practical Flow Chart for Pathologist Guidance. *Healthcare (Basel).* 2021; 9(7): 870.
  9. **Özdemir B, Celbiş O, Onal R, Mızrak B, Karakoç Y.** Multiple Organ Pathologies Underlying in Sudden Natural Deaths. *Med Sci.* 2012; 1(1): 13-26.
  10. **Tung, P, Albert C.** Causes and prevention of sudden cardiac death in the elderly. *Nat Rev Cardiol.* 2013; 10: 135-142.
  11. **Bhagora L, Parmar A, Parmar C, Patel T.** Analysis of Sudden Death cases brought for postmortem examination at Sir T. General Hospital, Bhavnaga. *J Indian Acad Forensic Med.* 2016; 38(4): 423.
  12. **Rao BH, Sastry BK, Chugh SS, et al.** Contribution of sudden cardiac death to total mortality in India - a population-based study. *Int J Cardiol.* 2012; 154 (2):163-167.
  13. **Chaudhari SH, Mugadlimath A, Sane M, Zine KU, Ingale DI, Hiremath R.** Study of sudden natural deaths in medico-legal autopsies with special reference to cardiac causes. *Int J Cur Res Rev.* 2013; 5(3): 37-42.
  14. **Chaudhari VA, Mohite SC.** Socio-demographic and clinical profile of sudden natural deaths in South Mumbai, India. *Int J Res Med Sci.* 2016; 4(7): 2947-50.
  15. **Bestetti RB, Costa RS, Zucolotto S, Oliviera JSM.** Fatal outcome associated with autopsy proven myocardial bridging of the left anterior descending coronary artery. *Eur Heart J.* 1989; 10(6): 573-576.
  16. **William C, Roberts MD,** Sudden cardiac death: A diversity of causes with focus on atherosclerotic coronary artery disease. *Am J Cardiol.* 1990; 65(4): 13-19.
  17. **Rao D, Sood D, Pathak P, Dongre SD.** A Cause of Sudden Cardiac Deaths on Autopsy Findings; a Four-Year Report. *Emerg (Tehran).* 2014; 2(1): 12-7.
  18. **Thomas AC, Knapman PA, Krikler DM, Davies MJ.** Community study of the causes of "natural" sudden death. *BMJ.* 1988; 297 (6661): 1453-6.
  19. **Choudhury A, Baruah AM, Das H.** Burden and commonest cause of sudden natural death among medicolegal autopsies in a tertiary care centre: A retrospective study. *Int J Health Res Med Leg Practice.* 2021; 7(2): 38-42.

