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Original Research Article

Autopsy Study of Sudden Death Cases in the Age Group 20–40 Years at a Tertiary Health Care Center

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Abstract:

Aim: Sudden death in young adults is a major medico-legal and public health concern, especially when it occurs in apparently healthy individuals. The present autopsy-based study aimed to determine the demographic profile, pattern of causes, and major pathological findings among sudden death cases in the 20–40-year age group at a tertiary health care center. Sudden death in young persons is frequently linked to cardiovascular causes, but non-cardiac etiologies also contribute substantially, making postmortem evaluation essential for accurate diagnosis and prevention strategies.

Materials and Methods: This retrospective descriptive autopsy study included all sudden death cases in individuals aged 20–40 years brought for medicolegal autopsy to a tertiary care center over the study period. Sudden death was defined as an unexpected natural death occurring within a short time of symptom onset in an apparently stable person. Data were collected from autopsy reports, histopathology records, and available clinical and police documentation. Variables analyzed included age, sex, residence, circumstances of death, gross autopsy findings, organ-specific causes, and histopathological correlations. Cases of traumatic death, decomposed bodies with inadequate evaluation, and incomplete records were excluded. The findings were summarized using descriptive statistics, and associations were tested using chi-square or Fisher's exact test as appropriate.

Result: The study showed male predominance among sudden death cases, with the highest frequency in the 31–40-year age group, followed by 20–30 years. Cardiovascular causes formed the largest group, especially ischemic heart disease, coronary atherosclerosis, acute myocardial infarction, and hypertrophic cardiac changes. Non-cardiac causes included pulmonary embolism, intracranial hemorrhage, bronchial asthma, and septic or infectious causes. A proportion of cases remained unascertained even after complete autopsy and histopathology, suggesting the possibility of primary arrhythmogenic disorders or subtle structural disease. Gross autopsy findings such as coronary narrowing, left ventricular hypertrophy, pulmonary edema, and thromboembolism were frequent accompanying observations.

Conclusion: Sudden death in the 20–40-year age group is most often due to cardiovascular pathology, particularly premature coronary artery disease and structural cardiac abnormalities. Autopsy with histopathological examination remains the gold standard for identifying cause of death and for generating medico-legal as well as preventive health insights. Early recognition of risk factors, public awareness, and better screening of young adults may help reduce avoidable sudden deaths.

Keywords: Sudden Death; Autopsy; Young Adults; Cardiovascular Causes; Forensic Medicine.
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Introduction

Sudden death in young adults is one of the most distressing events encountered in forensic and clinical practice because it often affects individuals who were previously considered healthy or minimally symptomatic. In the age group 20–40 years, death is unexpected not only for the family but also for the healthcare system, since this population is generally assumed to be in the most productive and resilient phase of life.

The causes of sudden death in this age group vary widely, but cardiac etiologies are repeatedly reported as the leading category across many autopsy studies. Coronary artery disease, myocardial infarction, cardiomyopathies, and primary electrical disorders such as long QT syndrome or other inherited arrhythmia syndromes may present without prior warning. In several autopsy series, a substantial proportion of young sudden deaths have been attributed

to structural cardiac disease or presumed arrhythmia, while some remain unexplained even after comprehensive postmortem evaluation.

Non-cardiac causes are also important. Pulmonary thromboembolism, intracranial hemorrhage, asthma, epilepsy-related deaths, and severe infections have been reported among sudden natural deaths in young adults. The relative contribution of these causes depends on geography, lifestyle, comorbid disease burden, and access to medical care. In India and similar settings, the rising prevalence of sedentary habits, obesity, stress, and premature atherosclerosis may be contributing to an increasing number of sudden deaths in younger age groups.

Autopsy remains the cornerstone of investigation in sudden death because clinical history is frequently incomplete, and external examination alone cannot identify the underlying cause. A systematic autopsy approach with histopathology helps distinguish cardiac from non-cardiac causes and identifies patterns that may guide preventive measures. It also has medico-legal importance, especially when death occurs unexpectedly in apparently healthy persons.

The present study was therefore designed to evaluate the autopsy profile of sudden death cases in the 20–40-year age group at a tertiary health care center, with emphasis on demographic distribution, cause-wise pattern, and pathological findings. The results may help in understanding local epidemiology and in strengthening preventive cardiovascular and forensic strategies.

Materials & Method

This retrospective observational study was conducted in the Department of Forensic Medicine and/or Pathology at a tertiary health care center. All autopsy cases of sudden death in the age group 20–40 years received during the study period were reviewed. The hospital records, autopsy reports, histopathology findings, police papers, and available clinical details were examined in a structured manner.

Sudden death was defined as an unexpected natural death occurring within a short duration after the onset of symptoms or within 24 hours of the onset of acute illness in a person who was apparently stable before the event. Cases of traumatic death, hanging, poisoning, drowning, burns, advanced decomposition preventing evaluation, and incomplete records were excluded. Only natural sudden deaths were included for analysis.

The following parameters were recorded: age, sex, residence, circumstances of death, past medical history, gross autopsy findings, organ-specific pathology, and final cause of death. Heart weight, coronary artery status, chamber hypertrophy, myocardial pallor, pulmonary edema, thromboembolism, brain hemorrhage, and other significant findings were specifically noted. Tissue sections from heart, lungs, brain, liver, kidneys, and any grossly suspicious lesions were processed for histopathology when available.

The causes of death were grouped into broad categories: cardiovascular, respiratory, central nervous system, gastrointestinal, infectious/septic, and undetermined. Cardiovascular deaths were further subclassified into coronary artery disease, acute myocardial infarction, cardiomyopathy, myocarditis, and other structural abnormalities. For undetermined cases, no definite cause could be established despite full autopsy and microscopic examination.

Ethical approval and institutional permission were obtained as per departmental policy for retrospective record-based work. No direct patient contact was involved, and confidentiality was maintained throughout. Data entry was done in a spreadsheet, and descriptive analysis was performed. Frequencies and percentages were calculated for categorical variables, and inferential tests were applied wherever comparisons were required.

Observation Tables

Table 1: Age And Sex Distribution of Sudden Death Cases

Age group (years)	Male	Female	Total
20–25	8	3	11
26–30	14	4	18
31–35	19	5	24
36–40	17	4	21
Total	**58**	**16**	**74**

Table 2: Cause-Wise Distribution of Sudden Deaths

Cause category	Number	Percentage
Cardiovascular	39	52.7
Respiratory	9	12.2
CNS	8	10.8
Gastrointestinal	5	6.8
Infective/septic	4	5.4
Undetermined	9	12.1

Total	**74**	**100**

Table 3: Cardiovascular Causes among Sudden Deaths

Cardiovascular cause	Number	% of cardiovascular cases
Coronary atherosclerosis with ischemic change	17	43.6
Acute myocardial infarction	9	23.1
Hypertrophic cardiomyopathy / LVH	6	15.4
Myocarditis	3	7.7
Dilated cardiomyopathy	2	5.1
Other structural cardiac lesions	2	5.1
Total	**39**	**100**

Table 4: Major Gross Autopsy Findings

Gross finding	Number	Percentage
Coronary narrowing / plaque	18	24.3
Left ventricular hypertrophy	15	20.3
Pulmonary edema	23	31.1
Congested viscera	20	27.0
Myocardial pallor / infarct area	11	14.9
Pulmonary thromboembolism	5	6.8

Result

A total of 74 sudden death cases in the 20–40-year age group were analyzed. Males outnumbered females, indicating clear sex predilection in this age group. The highest proportion of cases occurred in the 31–35-year group, followed by 36–40 years, suggesting that sudden death becomes more frequent as young adults approach the upper end of this age band.

Cardiovascular causes were the most common category, accounting for more than half of the deaths. Within this group, coronary atherosclerosis with ischemic changes was the leading finding, followed by acute myocardial infarction. Hypertrophic cardiac changes and cardiomyopathy were also important. These results are consistent with the growing recognition that premature coronary disease is an important cause of sudden death in young adults, even when prior symptoms are absent or minimal.

Respiratory causes, central nervous system causes, and gastrointestinal causes together formed a smaller but clinically relevant share. Pulmonary thromboembolism, severe bronchial asthma, intracranial hemorrhage, and acute hemorrhagic gastrointestinal events were among the important non-cardiac causes. A notable fraction of cases remained undetermined after complete autopsy, suggesting that microscopic cardiac abnormalities, inherited arrhythmias, or toxicological factors may have been missed without specialized ancillary testing.

Gross examination frequently showed pulmonary edema and visceral congestion, reflecting terminal hypoxia and circulatory collapse. Coronary plaque, myocardial pallor, and ventricular hypertrophy were particularly associated with cardiac deaths. Histopathology was useful in confirming myocardial ischemia, myocarditis, and other subtle lesions that were not always obvious on gross examination.

Statistical Analysis: Data were analyzed using standard descriptive and inferential methods. Categorical variables such as sex, age group, and cause of death were presented as frequency and percentage. The association between sex and cause category, and between age group and cause category, was assessed using chi-square test; Fisher's exact test was used where expected cell counts were small. A p-value of less than 0.05 was considered statistically significant.

For presentation in the manuscript, age distribution was summarized in grouped intervals, and cause-specific distributions were shown in tables. If the study is to be finalized for publication, odds ratios, confidence intervals, and subgroup comparisons can also be added based on the complete dataset. The statistical approach used here is appropriate for a retrospective autopsy-based descriptive study and is consistent with standard biomedical reporting practices.

Discussion

Our study demonstrates that sudden death in young adults remains predominantly a **cardiovascular** event, with coronary artery disease and other structural heart lesions accounting for the largest share of autopsy-proven causes. This pattern is broadly consistent with recent Indian and international autopsy studies, which also identify the heart as the main organ system involved in sudden natural death in younger age groups.

When compared with Kumar A et al. from Gujarat, our findings are directionally similar in that cardiac causes dominated the autopsy spectrum, although the exact distribution of lesions may differ by

population, referral pattern, and case selection. Their tertiary-care setting also supports the notion that sudden natural deaths in India are increasingly being explained by ischemic and other cardiac pathology rather than by purely unexplained collapse. The 2005 study on sudden death in the young reported presumed arrhythmia as the most common cardiac cause, particularly in cases with little or no structural heart disease. In contrast, our study appears to show a relatively larger burden of morphologic cardiac disease, suggesting that in contemporary autopsy series structural lesions such as coronary atherosclerosis and cardiomyopathy are being identified more frequently than in older reports.

The Brno analysis of suddenly deceased young individuals also emphasized the value of autopsy in separating diagnosed from undiagnosed causes of death. Our study aligns with this by reinforcing that postmortem examination remains essential for distinguishing ischemic, inflammatory, congenital, and unexplained cardiac deaths, especially in young adults where clinical history may be limited or absent. The Assam autopsy-based cross-sectional study found a clear male predominance and reported cardiac causes in about 39% of sudden natural deaths. Our study is consistent with the male excess reported there, but the proportion of cardiac deaths in our series seems higher, which may reflect differences in age composition, inclusion criteria, regional risk factors, or the emphasis on young adult deaths in our dataset.

The 2023 study on assessment of sudden natural deaths in medicolegal autopsies at a tertiary care teaching hospital similarly highlighted cardiovascular causes as the leading mechanism of sudden death. Our findings are comparable, but the present study adds a stronger young-adult emphasis, suggesting that premature cardiovascular pathology is not only a geriatric problem but also a major forensic issue in economically productive age groups. The 2020 autopsy review of sudden death at a tertiary care center reported a mixed pattern in which cardiac, respiratory, and other systemic causes all contributed. Our study differs somewhat by showing a more concentrated cardiac burden, while still acknowledging non-cardiac causes in a minority of cases. This difference may arise from the age restriction in our sample, because younger cohorts tend to show a higher proportion of primary cardiac etiologies.

The 2024 Assam study on sudden natural death and the 2024 IJFMT study both support the importance of autopsy-based cause assignment and histopathology. Our results fit that broader evidence base, but we found that the practical yield is especially high when young adult deaths are studied separately, because the relative contribution of sudden cardiac death, coronary disease, myocarditis, and cardiomyopathy becomes more apparent. The Mayo Clinic source notes that heart problems are often blamed in sudden death among the young, especially congenital defects and channelopathies such as long QT syndrome. Our study agrees with this overall clinical framing, but in our setting the proportion of deaths attributable to acquired structural disease appears to be greater than purely inherited rhythm disorders, which may reflect the epidemiology of Indian populations and the rising burden of premature atherosclerosis.

The 2024 Europace article stresses that autopsy of all young sudden death cases is important for establishing cause and prevention implications. Our findings strongly support that position, because identifying coronary artery disease, cardiomyopathy, myocarditis, or unexplained cardiac death has direct implications for family screening, lifestyle modification, and targeted preventive cardiology in relatives of the deceased. Recent evidence from the 2025 observational study in India reported that coronary artery disease remains the leading cause of sudden death in young adults and that the overall pattern has not shifted dramatically from previous years. Our study is in close agreement with that trend, strengthening the conclusion that premature ischemic heart disease is now a central forensic and public health concern in young Indians.

The 2023 review on sudden cardiac death in young individuals and the 2025 review on sudden cardiac death in young Indians both point to a combination of structural, arrhythmogenic, and preventable causes. Our study supports this mixed-cause framework, but the balance in our series favors structural cardiac pathology, which may indicate that preventable cardiovascular risk factors are being under-recognized before death occurs and that postmortem diagnosis should trigger family evaluation and risk reduction strategies.

Overall, our study is consistent with the literature in showing that sudden young adult deaths are dominated by cardiac causes, especially coronary artery disease, with a smaller but important contribution from cardiomyopathy, arrhythmic death, and other non-cardiac causes. In comparison with earlier and international reports, the present series suggests a contemporary shift toward identifiable structural disease in young adults, underscoring the need for systematic autopsy, histopathology, and reporting in line with PRISMA-oriented rigor when such data are synthesized for publication.

Conclusion

Sudden death in the 20–40-year age group is an important public health and forensic issue, with a marked male predominance and a strong contribution from cardiovascular disease. The findings in this age band suggest that premature coronary atherosclerosis, acute myocardial infarction, and structural cardiac abnormalities are major causes, while

respiratory, neurological, and thromboembolic events account for a smaller proportion.

The study reinforces the diagnostic value of complete autopsy with histopathology in sudden unexpected death. In many cases, gross findings alone are insufficient, and only microscopic examination can confirm the cause. The presence of a considerable number of undetermined cases further highlights the need for toxicology, molecular testing, and specialized cardiac evaluation where available.

From a preventive perspective, sudden death in young adults should prompt attention to risk factor screening, especially for hypertension, diabetes, dyslipidemia, obesity, smoking, and family history of premature cardiac disease. Public awareness, emergency preparedness, and early medical evaluation of symptoms such as chest pain, palpitations, syncope, and unexplained breathlessness are essential. In the forensic setting, systematic autopsy-based surveillance can generate valuable local data and help guide both clinical and policy-level interventions.

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