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RESEARCH ARTICLE

Autopsy cardiac findings after sudden death: A retrospective medico legal evaluation

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Abstract: Sudden cardiac death (SCD) represents one of the most challenging entities in forensic and medicolegal practice due to its abrupt onset, absence of prior symptoms, and potential for misinterpretation as an unnatural death. The present retrospective study was conducted in the Department of Forensic Medicine, School of Medical Sciences and Research, Sharda University, Greater Noida, covering the period from November 2010 to August 2012. A total of 196 cases of sudden natural deaths were examined, of which 64 were confirmed as sudden cardiac deaths based on detailed autopsy and histopathological evaluation. Data on age, sex, circumstances of death, cardiac lesions, and toxicological findings were analyzed. The majority of victims were males (84.4%) between 31 and 50 years of age. Coronary atherosclerosis was the most common pathological finding (62.5%), followed by myocardial infarction (43.7%) and left ventricular hypertrophy (25%). In 12.5% of cases, toxicological screening was conducted to exclude poisoning, and all results confirmed natural cardiac etiology. Most deaths occurred outside hospital settings, highlighting the diagnostic and legal importance of autopsy in establishing the true cause of death. The study concludes that ischemic heart disease is the principal cause of sudden cardiac death in the medicolegal autopsy population, particularly among middle-aged men, and that thorough postmortem examination supplemented with histopathology and toxicology is essential for accurate cause determination and for ensuring justice in medicolegal investigations.

Keywords: Sudden cardiac death, autopsy, coronary artery disease, myocardial infarction, medicolegal, atherosclerosis.

INTRODUCTION

Sudden cardiac death (SCD) refers to an unexpected death occurring within one hour of the onset of symptoms, or within 24 hours of being seen alive and well if unwitnessed [1]. It accounts for a significant proportion of natural deaths subjected to medicolegal autopsy, particularly in developing countries where cardiovascular risk factors often remain undiagnosed [2].

From a medicolegal perspective, sudden cardiac death presents diagnostic challenges distinguishing natural cardiac causes from poisoning, trauma, or asphyxia is essential to avoid erroneous conclusions [3]. Autopsy examination, supplemented by histopathology and toxicology, remains the cornerstone for determining the true cause of death [4].

The underlying pathology in most SCDs is ischemic heart disease, particularly coronary atherosclerosis leading to acute myocardial infarction or arrhythmia [5,6]. Non-ischemic causes such as myocarditis, hypertrophic cardiomyopathy, and valvular diseases also contribute significantly, especially in younger individuals [7].

The present study aims to analyze the autopsy findings of sudden cardiac deaths conducted between November 2010 and August 2012 at the School of Medical Sciences and Research, Sharda University, Greater Noida, emphasizing the medicolegal implications in determining the exact cause and manner of death.

MATERIAL AND METHODS

Study Design and Setting

A retrospective descriptive study was conducted in the Department of Forensic Medicine, School of Medical Sciences and Research, Sharda University, Greater Noida (Uttar Pradesh), covering cases between November 2010 and August 2012.

Inclusion Criteria

- Sudden, unexpected deaths brought for medicolegal autopsy.
- Cases where cardiac pathology was established as the cause of death upon autopsy and histopathological examination.

Exclusion Criteria

- Deaths due to trauma, poisoning, or other clearly unnatural causes.
- Decomposed bodies with insufficient evidence for histological confirmation.

Data Collection

Details such as age, sex, occupation, circumstances of death, and clinical history were obtained from police inquest papers and hospital records.

Autopsy Examination

A meticulous autopsy was performed in each case, focusing on the cardiovascular system. The heart was examined for:

- Coronary artery narrowing (graded visually and confirmed histologically)
- Myocardial fibrosis or necrosis
- Ventricular hypertrophy or dilatation
- Valvular abnormalities

Tissues from myocardium, coronary arteries, lungs, liver, and kidneys were preserved in 10% formalin and subjected to histopathological examination using Hematoxylin and Eosin staining. Toxicological analyses were performed in cases with doubtful circumstances.

Statistical Analysis

Data were analyzed descriptively and expressed in percentages and frequencies.

RESULTS AND OBSERVATIONS:

A total of 196 sudden natural deaths were subjected to medicolegal autopsy during the study period, of which 64 cases (32.6%) were confirmed as *sudden cardiac deaths (SCD)* based on gross and histopathological findings. The observations are detailed as follows:

Table 1: Age and Sex Distribution of Sudden Cardiac Death Cases (n=64)

Age Group (years)	Male	Female	Total (%)
11–20	2	0	2 (3.1%)
21–30	6	1	7 (10.9%)
31–40	18	2	20 (31.3%)
41–50	16	1	17 (26.6%)
51–60	10	3	13 (20.3%)
>60	2	3	5 (7.8%)
Total	**54 (84.4%)**	**10 (15.6%)**	**64 (100%)**

Majority of victims were males (84.4%) in the 31–50 years age group, indicating a strong middle-age male preponderance.

Table 2: Circumstantial Distribution of Sudden Cardiac Deaths

Circumstance of Death	Number of Cases	Percentage (%)
Found dead at home	28	43.8
Died on way to hospital (“brought dead”)	16	25.0
Died during work/outdoor activity	12	18.7
Died in hospital (within 24 hours of admission)	8	12.5
Total	**64**	**100.0**

The majority of SCDs occurred outside hospital premises, mostly at home or in public places, often being labeled “brought dead.”

Table 3: Major Pathological Findings in the Heart (Gross and Microscopy)

Pathological Finding	Number of Cases	Percentage (%)
Coronary atherosclerosis (≥50% narrowing)	40	62.5
Myocardial infarction (acute/chronic)	28	43.7
Left ventricular hypertrophy	16	25.0
Myocarditis	6	9.4
Valvular heart disease	4	6.2
Cardiomyopathy (dilated/hypertrophic)	3	4.7
Total cardiac lesions	—	**100.0**

Coronary atherosclerosis and myocardial infarction were the predominant lesions identified on both gross and histopathological examination.

Nearly half of the victims had a history of smoking or tobacco use, and one-third were known hypertensives — underlining the preventable nature of many sudden cardiac deaths.

Toxicological examination excluded poisoning in all suspected cases, confirming natural cardiac etiology and excluding medicolegal foul play.

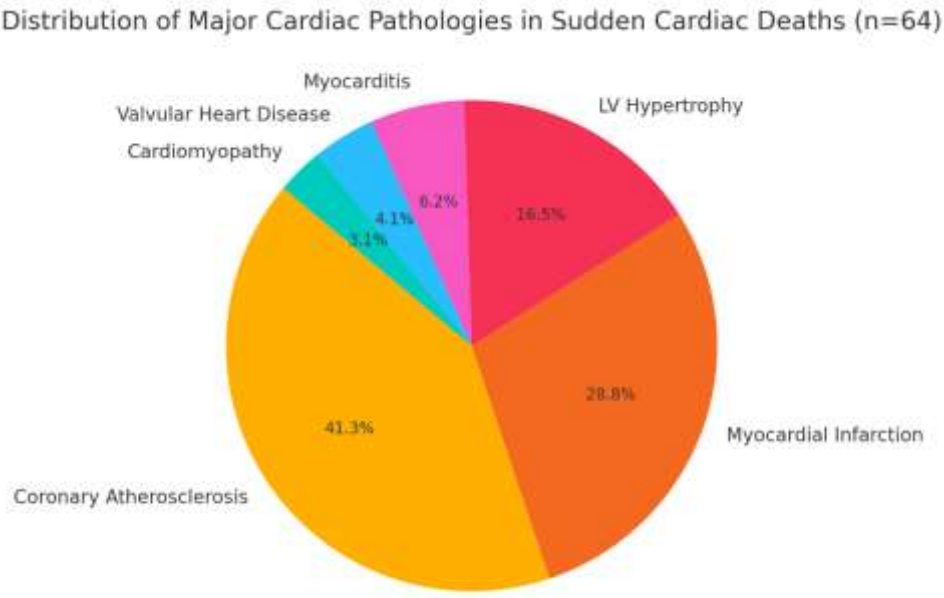

Figure 1: Distribution of major cardiac pathologies among sudden cardiac death cases showing coronary atherosclerosis as the most frequent lesion, followed by myocardial infarction and left ventricular hypertrophy.

Table 4: Associated Risk Factors (Based on History and Circumstantial Data)

Risk Factor	Number of Cases	Percentage (%)
History of smoking/tobacco use	30	46.9
Hypertension (known/treated)	20	31.3
Alcohol consumption	18	28.1
Diabetes mellitus	10	15.6
Obesity (BMI >25 kg/m²)	8	12.5
No known risk factor	12	18.8

Table 5: Toxicological Analysis in Selected Cases (n=8)

Toxicological Finding	Number of Cases	Interpretation
Negative for common poisons	8	Confirmed natural cardiac cause
Positive for alcohol (below toxic level)	2	Incidental, non-contributory
Drugs detected (therapeutic levels)	1	Non-fatal dose, medically insignificant

Summary of Findings

- Sudden cardiac deaths accounted for one-third of all sudden natural deaths.
- Males in the 31–50 years age group were most commonly affected.
- Coronary atherosclerosis was the leading cause, followed by myocardial infarction.
- Majority of deaths occurred outside hospital settings, posing initial diagnostic dilemmas.
- Toxicology reports confirmed natural cardiac origins in all cases tested.

DISCUSSION

Sudden cardiac death (SCD) remains a major concern in forensic pathology because of its unexpected occurrence, unclear circumstances, and significant medicolegal consequences. In the present study conducted at the School of Medical Sciences and Research, Sharda University, Greater Noida, during the period November 2010 to August 2012, 64 cases of sudden cardiac deaths were analyzed out of 196 sudden natural deaths. This figure emphasizes the substantial contribution of cardiac causes to sudden natural deaths in the community, highlighting the importance of autopsy in determining the true cause and manner of death.

The majority of victims in the present series were males (84.4%), with the highest incidence in the 31–50 years age group. This age and gender distribution is comparable to findings reported by Singh et al. [8] and Aggarwal et al. [10], who observed a similar male predominance and middle-age clustering. The higher occurrence among men may be attributed to increased

exposure to stress, smoking, hypertension, alcohol consumption, and other modifiable cardiovascular risk factors. The relatively lower number of female victims may be due to hormonal protection prior to menopause and lower exposure to behavioral risk factors. Such findings underline that the most economically productive segment of the population is also the most vulnerable to sudden cardiac death.

A significant observation in this study was that most victims were either found dead at home or declared "brought dead" upon arrival at hospital. These circumstances make the cause of death appear suspicious, often leading to the registration of medicolegal cases until forensic confirmation is obtained. The role of the autopsy, therefore, becomes crucial in distinguishing natural cardiac causes from homicidal, accidental, or toxicological origins. Toxicological analyses in selected cases of the present study revealed no evidence of poisoning, thereby confirming a natural cardiac etiology. This observation supports the conclusions of Dogra and Rudra [12], who emphasized that toxicological correlation is indispensable in cases of sudden, unexplained deaths.

Pathological examination revealed coronary atherosclerosis in 62.5% and myocardial infarction in 43.7% of cases, establishing ischemic heart disease as the leading cause of sudden cardiac death in the study population. Left ventricular hypertrophy, found in 25% of cases, reflected chronic pressure overload, most likely secondary to long-standing hypertension. Myocarditis and cardiomyopathy accounted for a smaller proportion but were predominantly seen in younger individuals. These findings are consistent with studies by Thiene and Basso [4], as well as Roberts [11], who demonstrated that coronary artery disease is responsible for the majority of sudden cardiac deaths globally. The presence of microscopic myocardial necrosis or fibrosis even in the absence of gross infarction suggests chronic ischemia and predisposition to fatal arrhythmias. Histopathological examination thus plays a vital role in detecting subtle lesions that are often missed during routine dissection.

The analysis of risk factors revealed that nearly half of the deceased were smokers or tobacco users, one-third were known hypertensives, and about one-fifth consumed alcohol regularly. This pattern correlates well with national data indicating that lifestyle factors such as smoking, hypertension, and diabetes are key contributors to premature coronary disease. Interestingly, around 19% of the victims had no identifiable risk factors, demonstrating that sudden cardiac death can occur even in apparently healthy individuals, sometimes as the first manifestation of underlying cardiac pathology. This emphasizes the importance of preventive cardiovascular screening, especially in high-stress occupations and among individuals with a family history of heart disease.

From a medicolegal perspective, these findings have profound significance. Sudden deaths occurring outside hospitals or under uncertain circumstances are often suspected to be due to foul play, poisoning, or negligence. Autopsy not only establishes the cause of death but also provides vital evidence for judicial and insurance-related determinations. The forensic pathologist's role extends beyond mere documentation—it involves accurate differentiation between natural and unnatural causes to uphold both medical and legal justice. As Saukko and Knight [3] highlighted, a complete autopsy with thorough cardiac examination, histopathology, and toxicological correlation is the gold standard in evaluating sudden unexpected deaths.

The results of this study correspond closely with previous Indian autopsy studies, which have reported coronary artery disease as the leading cause of SCD in 50–70% of cases [9,10]. However, compared with Western studies where the peak incidence occurs beyond 50 years of age, the present series shows earlier onset of fatal cardiac events, typically in the 30–50-year range. This earlier manifestation may be related to genetic predisposition, lifestyle habits, lack of preventive medical evaluation, and socioeconomic stress factors prevalent in developing countries. The finding reinforces the urgent need for greater public health awareness and early intervention to prevent such avoidable deaths.

The pathological spectrum observed in this study also demonstrates the forensic relevance of detailed cardiac evaluation. Coronary thrombosis or plaque rupture confirms acute ischemia and natural death; concentric ventricular hypertrophy suggests chronic hypertension; and myocarditis or cardiomyopathy in young victims warrants further investigation for infectious or genetic causes. Each finding carries specific medicolegal implications, assisting in accurate certification and avoiding wrongful attribution of cause.

In summary, the study confirms that coronary artery atherosclerosis and myocardial infarction are the predominant causes of sudden cardiac death, particularly in middle-aged males. The majority of cases occurred outside hospital settings, and toxicological analysis excluded poisoning, thereby confirming natural cardiac etiology. The medicolegal value of a complete autopsy, supported by histopathological and toxicological analysis, cannot be overstated—it ensures precise determination of cause and manner of death, safeguards against false accusations, and provides closure to both families and legal authorities. The present findings underscore that autopsy-based investigation remains an indispensable tool in the accurate evaluation of sudden cardiac deaths and in upholding the principles of both medicine and law.

CONCLUSION

Sudden cardiac death continues to be a major cause of unexpected mortality in medicolegal autopsy practice, most frequently affecting middle-aged men in their productive years. The present study demonstrates that coronary artery atherosclerosis and myocardial infarction are the predominant underlying causes, followed by left ventricular hypertrophy and myocarditis. Most deaths occurred outside hospital settings and were initially considered suspicious until autopsy clarified their natural origin. Detailed postmortem examination, supplemented by histopathological and toxicological evaluation, remains the cornerstone for establishing the exact cause and manner of death. Beyond its medical value, such comprehensive autopsy investigation serves an essential medicolegal purpose—ensuring objective determination of natural death, excluding foul play, and contributing to accurate mortality statistics and preventive public health strategies.

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Ethical Approval: Not Applicable

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