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HISTOMORPHOLOGICAL SPECTRUM OF CARDIAC LESIONS IN MEDICOLEGAL AUTOPSIES: A CROSS-SECTIONAL STUDY FROM A TERTIARY CARE CENTRE IN TELANGANA

Pathology

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ABSTRACT

Sudden Cardiac Death (SCD) is a major global health burden, often occurring in individuals with no prior history of heart disease. In India, the incidence of cardiovascular disease is rising among younger populations. Autopsy remains the gold standard for identifying the underlying pathology in sudden, unexpected deaths. To evaluate the histomorphological spectrum of cardiac lesions in medicolegal autopsy cases, determine the age and sex distribution of these lesions, and identify incidental or silent cardiac pathologies. This cross-sectional observational study was conducted at the Department of Pathology, Osmania Medical College, Hyderabad, from January 2023 to May 2025. A total of 120 heart specimens from medicolegal autopsies were analyzed. Specimens underwent gross examination using the inflow-outflow technique, followed by detailed histopathological evaluation using Hematoxylin and Eosin (H&E) staining. Of the 120 cases, 85 (70.8%) were males and 35 (29.1%) were females. The peak incidence of cardiac lesions was observed in the 31–40 and 41–50 year age groups. Coronary atherosclerosis was the most prevalent lesion, seen in 75 cases (62.5%), with significant involvement of the Left Anterior Descending (LAD) artery. Other findings included myocardial infarction (3.3%), cardiomyopathy (0.83%), and rare cases of myocarditis, mucormycosis, leukemic infiltration into the myocardium. A significant association was found between age and the distribution of heart lesions ($p < 0.05$). The study highlights a high prevalence of silent coronary atherosclerosis, particularly in young adult males, necessitating early screening and preventive strategies. Rare findings like leukemic infiltration underscore the importance of meticulous histopathological examination in all autopsy cases.

KEYWORDS

Atherosclerosis, Autopsy, Histopathology, Myocardial Infarction, Sudden Cardiac Death, Leukemia.

INTRODUCTION

Cardiovascular diseases (CVDs) have emerged as the pre-eminent cause of morbidity and global mortality over the last five decades, particularly within urban populations. According to the Global Burden of Disease Study, Ischemic Heart Disease (IHD) accounts for approximately 1.6 million deaths annually in India, representing nearly 15% of total mortality.[1] The epidemiological transition in India has been marked by a shift toward non-communicable diseases, driven by rapid urbanization, sedentary lifestyles, dietary changes, and an increasing prevalence of hypertension and diabetes mellitus.[2]

A particularly alarming trend is the rising incidence of "Sudden Cardiac Death" (SCD) among younger demographics. SCD is defined as unexpected death due to cardiac causes occurring within a short time frame (usually 1 hour) of symptom onset, or in asymptomatic individuals found dead within 24 hours.[3] In many such instances, the death is unwitnessed, and the individual may have appeared healthy prior to the event. Consequently, the postmortem examination becomes the sole modality to ascertain the precise cause of death and to differentiate structural cardiac abnormalities from other causes.

While atherosclerosis remains the predominant aetiology, accounting for over 80% of CVD-related deaths, the spectrum of cardiac pathology is vast.[4] It encompasses congenital anomalies, cardiomyopathies (dilated, hypertrophic, restrictive), myocarditis, valvular pathologies, and rare neoplastic infiltrations. Clinical diagnostic tools, while advanced, often fail to detect subclinical or "silent" diseases that eventually precipitate fatal arrhythmias. Autopsy studies, therefore, serve as a retrospective audit of cardiac health in the community, revealing the true prevalence of lesions that remain undiagnosed during life.[5]

This study aims to analyse the histomorphological spectrum of heart lesions in medicolegal autopsy cases at a tertiary care center in Telangana. By correlating gross and microscopic findings with demographic data, this research seeks to provide regional epidemiological insights, specifically highlighting the burden of premature atherosclerosis and documenting rare incidental findings such as leukemic infiltration of the heart.

MATERIALS AND METHODS

This was a cross-sectional study conducted in the Upgraded Department of Pathology at Osmania Medical College, Hyderabad, Telangana. The study period spanned two years from 2023 to 2025. The study included 120 whole heart specimens received from the mortuary of Osmania General Hospital for histopathological evaluation. All heart specimens from medicolegal autopsy cases received by the Department of Pathology were included, regardless of the stated cause of death on the police requisition, to ensure the detection of incidental findings. Autolysed specimens unsuitable for histological processing were excluded.

Specimens were weighed, measured and examined for external abnormalities, shape, and epicardial fat. The hearts were dissected using the standard "inflow-outflow" technique or the "short-axis" method (bread-loafing) of the ventricles to identify areas of fibrosis, necrosis, or scarring. The coronary arteries were serially sectioned at 3–5 mm intervals to evaluate luminal narrowing, plaque formation, and thrombosis. Representative tissue sections were taken, processed routinely, and embedded in paraffin. Sections of 4–5 micron thickness were cut and stained with Hematoxylin and Eosin (H&E). Slides were examined under light microscopy. Atherosclerosis was graded based on American Heart Association (AHA) criteria (Grade 1 to 4 based on luminal narrowing and plaque complexity). Myocardial infarction was categorized based on microscopic changes (coagulative necrosis, granulation tissue, fibrosis) into acute, healing, or healed phases.

Data were entered into Microsoft Excel and analyzed. Categorical variables were expressed as frequencies and percentages. The Chi-square test was utilized to determine the association between age, sex, and the presence of cardiac lesions. A p-value of <0.05 was considered statistically significant.

RESULTS

Among the total 120 heart specimens, the study population showed a distinct male predominance, with 85 males (70.83%) and 35 females (29.16%), resulting in a male-to-female ratio of 2.4 : 1. The age of the subjects ranged from 2 days to 76 years, with a mean age of 36 years.

The highest mortality was observed in the 31–40 years age group (25.8%, n=31), followed closely by the 21–30 years group (24.1%,

n=29). Notably, a significant proportion of cases (9.1%, n=11) involved subjects under 10 years of age, often related to non-atherosclerotic causes.

Table 1: Age And Sex Distribution Of Cases

Age Group (Years)	Male (n)	Female (n)	Total (n)	Percentage (%)
< 10	5	6	11	9.16%
11 - 20	4	8	12	10.00%
21 - 30	21	8	29	24.16%
31 - 40	22	9	31	25.83%
41 - 50	19	0	19	15.83%
51 - 60	7	3	10	8.33%
> 60	7	1	8	6.66%
Total	85	35	120	100%
Chi-square test p-value = 0.000148 (Statistically Significant)				

Spectrum Of Cardiac Lesions

Histopathological examination revealed significant cardiac pathology in 74.2% of cases, while 25.8% (n=31) showed no significant specific pathology.

Table 2: Histomorphological Spectrum Of Heart Lesion

Heart Lesions	No. of Cases	Percentage (%)
Atherosclerosis	75	62.5%
Infarcts	4	3.3%
Cardiomyopathy	4	3.3%
Thrombosis	2	1.6%
Ventricular Hypertrophy	2	1.6%
Myocarditis	1	0.83%
Metastasis (Leukemia)	1	0.83%
Mucormycosis	1	0.83%
No Significant Pathology	31	25.8%
Total	120	100%

- **Atherosclerosis:** This was the most frequent finding, observed in 75 cases (62.5%).
- **Ischemic Heart Disease:** Evident MI was seen in 4 cases (3.3%).
- Less common lesions included ventricular hypertrophy, cardiomyopathy, and thrombosis.
- **Rare Findings:** myocarditis, mucormycosis, leukemic infiltration into the myocardium.

Atherosclerosis was noted as early as the second decade of life. The highest prevalence was in the 31–40 year age group (23 cases), followed by the 21–30 year group (17 cases), indicating a shift toward younger onset.

Grading: Of the 75 cases with atherosclerosis, there were Grade I (Initial): 25 cases, Grade II (Moderate): 26 cases, Grade III (Significant stenosis): 17 cases, Grade IV (Severe stenosis/Complicated): 10 cases. Significantly, Grade IV lesions were found even in the 31–40 age group (2 cases), highlighting severe disease in young adults.

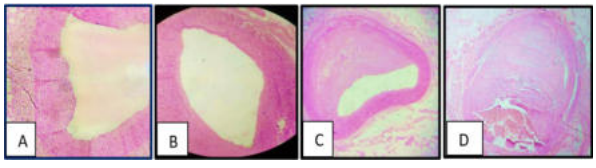

Figure 1: A. Grade I : <25% obstruction **B.** Grade II : 25-50% obstruction **C.** Grade III : 50-75% obstruction **D.** Grade IV : >75% obstruction

Single Vessel Disease (SVD) was the most common pattern (46.6%), followed by Double Vessel Disease (31.6%) and Triple Vessel Disease (21.6%). The Left Anterior Descending (LAD) artery was the most frequently affected vessel.

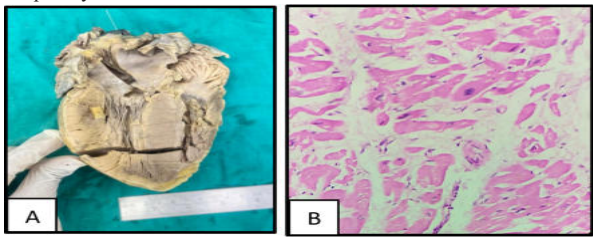

Figure 2: A. Hypertrophic cardiomyopathy showing septal and ventricular hypertrophy **B.** Hypertrophied cardiomyocyte with nuclear enlargement and hyperchromasia (H&E 40x)

Rare Findings:

Leukemic Infiltration: In a rare case involving a young adult male, gross examination was unremarkable, but microscopy revealed infiltration of the myocardial interstitium and blood vessels by immature leukemic cells. This was an incidental finding in a case where the primary cause of death was not initially attributed to malignancy.

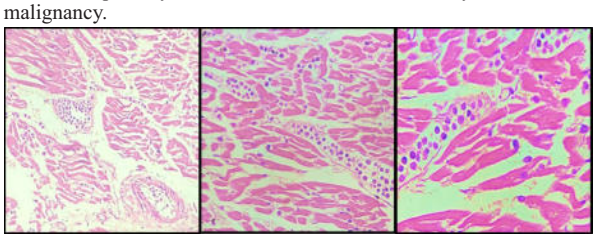

Figure 3: Leukemia cells seen infiltrating in the interstitium of myocardial fibers and also in the blood vessels. (H&E 4x, 10x, 40x)

Myocarditis: One case of lymphocytic myocarditis was identified, characterized by interstitial edema and lymphocytic infiltration associated with myocyte necrosis.

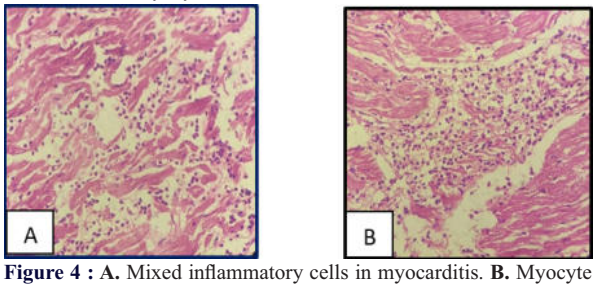

Figure 4 : A. Mixed inflammatory cells in myocarditis. **B.** Myocyte necrosis (H&E 10x)

Mucormycosis: One case of Mucormycosis was noted, showing aseptate ribbon like hyphae elements.

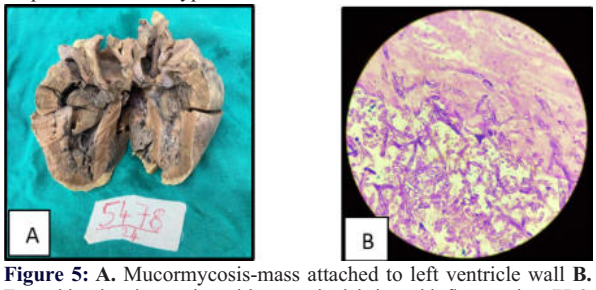

Figure 5: A. Mucormycosis-mass attached to left ventricle wall **B.** Fungal hyphae in tangles with necrotic debris and inflammation (H & E 10x)

The clinical history provided in the requisition forms varied. The most common presentation was "Sudden Unresponsive" (n=45), followed by "Sepsis" (n=9) and "Post-Seizure" (n=8). Interestingly, 8 cases had no documented history, yet autopsy revealed significant pathology, underscoring the silent nature of these diseases.

DISCUSSION

The present study provides a comprehensive histomorphological analysis of 120 cardiac autopsies, elucidating the burden of silent cardiac disease in the region. Our study demonstrated a male-to-female ratio of 2.4:1, consistent with global literature suggesting males are more predisposed to cardiovascular mortality. Similar findings were reported by Mahapatra et al. (2.6:1) and Chugh et al. (2.3:1).[6,7] This disparity is often attributed to the cardioprotective effects of estrogen in premenopausal women, alongside higher prevalence of risk factors such as smoking and alcohol consumption among males in the Indian demographic.

Crucially, the peak incidence of death occurred in the 31–60 year age group (cumulative 50 cases). This aligns with the growing body of evidence suggesting that the age of onset for cardiovascular events in Indians is significantly lower (approx. a decade earlier) compared to

Western populations.[8] Coronary atherosclerosis was the predominant lesion (62.5%), a figure comparable to findings by Shah et al. (61.18%) and Joshi et al. (65%).[9,10] Our study noted "subclinical" atherosclerosis (Grade I and II) in individuals as young as 20 years. The "Lipid Hypothesis" and early lifestyle factors likely contribute to this. The finding of Grade IV lesions (severe obstruction) in the 31–40 age group supports the need for primordial prevention strategies targeting young adults. The LAD was the most commonly involved vessel, consistent with the "widow-maker" reputation of LAD stenosis. Multi-vessel disease (DVD and TVD) constituted over 50% of atherosclerotic cases, indicating advanced disease progression even in asymptomatic individuals. While frank Myocardial Infarction (MI) was histologically confirmed in 3.3% of cases, this figure is lower than some studies (e.g., Garg et al. reported 14.1%).[11] This discrepancy may be due to the "sudden" nature of deaths included; individuals often succumb to arrhythmia (Ventricular Fibrillation) triggered by acute ischemia before histological changes of necrosis (which take 4–12 hours) become apparent. This highlights the limitation of standard H&E staining in detecting early ischemia (<4 hours), where enzyme histochemistry (TTC) would be required.

A unique finding in our study was the leukemic infiltration of the myocardium. Cardiac involvement in leukemia is often clinically silent but can be found in up to 25–40% of leukemia cases at autopsy.[12] The infiltration can lead to conduction disturbances, pericardial effusions, or mimicking of myocardial infarction due to leukostasis. Our finding emphasizes the role of the pathologist in identifying systemic diseases that present as sudden death.

We identified cases of myocarditis and mucormycosis. Though less common than atherosclerosis, myocarditis is a critical cause of SCD in the pediatric and young adult population (below 35 years), often viral in origin. Our findings align with Fabre and Sheppard, who emphasized myocarditis as a major cause of non-ischemic SCD.[13]

The study is limited by its sample size (n=120) and its restriction to a single tertiary center. The absence of genetic testing limits the classification of cardiomyopathies and channelopathies. Additionally, without enzyme histochemistry, very early myocardial infarcts may have been classified as "No significant pathology."

CONCLUSION

This autopsy-based study reveals a high prevalence of coronary atherosclerosis in the population of Telangana, with a disturbing onset in young adults. The significant burden of "silent" heart disease highlights the inadequacy of symptom-based diagnosis and the necessity for proactive screening.

The identification of incidental findings, such as leukemic infiltration and myocarditis, reinforces the indispensable value of the autopsy. It serves not only to determine the cause of death but also to audit the health status of the community. We recommend distinct policy shifts toward primordial prevention, focusing on lifestyle modifications for the Indian youth to mitigate the rising tide of premature cardiovascular mortality.

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