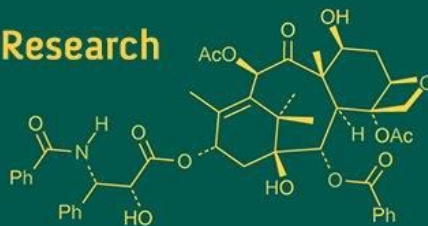


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Correlation between of heart diseases prevalence and autopsy histopathological analysis

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Abstract

Background: Cardiovascular disease is the leading cause of sudden and unexpected death worldwide. In forensic practice, autopsy with histopathological examination is essential when gross findings fail to establish the cause of death. This study aimed to evaluate the spectrum of histopathological cardiac findings in medicolegal autopsies.

Methods: A retrospective descriptive study was conducted from October 2023 to October 2024 and included 62 cardiac specimens obtained during medicolegal autopsies. Detailed gross examination was followed by histopathological evaluation using Hematoxylin and Eosin staining.

Results: The age of the deceased ranged from 13 to 89 years, with the highest frequency in the 51–60 year group (25.8%). Males predominated (67.74%). Coronary atherosclerosis was the most common finding (56.45%), with calcification in 40, 32% and superimposed thrombus in 6.45% of these cases. Myocardial infarction was identified in 12.9% of cases, predominantly old infarcts, Myocardial hypertrophy (8.06%), hypertrophy 11.29%, while myocarditis (4.83%), and pericarditis (3.22%) were less frequent. No specific pathology was detected in 12.9% of cases.

Conclusion: Coronary atherosclerosis remains the principal histopathological finding in sudden cardiac deaths, particularly among middle-aged males. Histopathological examination is indispensable in establishing the cause of death in medicolegal autopsies.

Keywords: Cardiovascular disease, sudden cardiac death, autopsy, histopathology

Introduction

With an anticipated 19.2 million fatalities in 2023—roughly one in three deaths worldwide—cardiovascular diseases (CVDs) continue to be the major cause of death and disability worldwide. Demographic changes like population aging and growth, as well as increased exposure to modifiable risk factors like high blood pressure and raised LDL cholesterol, as well as lifestyle variables like poor food and physical inactivity, are all contributing reasons to this growing burden ^[1].

Cardiovascular diseases (CVDs) remain the leading cause of mortality worldwide, accounting for approximately 19.2 million deaths in 2023, representing nearly one-third of all global deaths ^[2, 3]. The increasing burden of cardiovascular disease reflects demographic transitions, urbanization, aging populations, and growing exposure to modifiable risk factors such as hypertension, dyslipidemia, diabetes mellitus, obesity, and sedentary lifestyles ^[3, 4]. Recent global epidemiological analyses confirm that ischemic heart disease continues to be the principal contributor to cardiovascular mortality ^[3]. Despite significant advances in diagnostic cardiology including high-resolution imaging, cardiac biomarkers, and interventional techniques determining the exact pathological cause of sudden or unexpected cardiac death remains challenging ^[5]. Clinical records may fail to detect subclinical or silent cardiac pathology. In this context, medicolegal autopsy plays a crucial role in identifying structural and microscopic abnormalities responsible for death ^[6]. While gross examination provides important macroscopic findings, subtle myocardial ischemic changes, inflammatory infiltrates, and early atherosclerotic lesions may only be detected through histopathological evaluation ^[6]. Microscopic analysis enables confirmation of coronary atherosclerosis, myocardial infarction, myocarditis, hypertrophy, and other clinically significant lesions contributing to mortality ^[5, 6]. Moreover, autopsy-based histopathological data enhance epidemiological understanding of cardiovascular disease prevalence within specific

populations. Given the persistent global impact of cardiovascular diseases and the essential role of histopathology in forensic investigations, this study aims to evaluate the spectrum of histopathological cardiac findings in medicolegal autopsies and to assess their correlation with the prevalence of heart diseases in the studied population.

Methods

Data collection for this analysis began in October 2023 and continued until October 2024. The research comprised 141 cardiac specimens out of a total of 100. Examination of the postmortem records kept by the forensic medicine departments of several academic medical centers yielded epidemiological data and conclusions.

Gross examination of the heart

Detailed measurements and weights of the whole heart were documented. The outer layer was checked for signs of pericardial disease and recent or previous myocardial infarction. The inflow-outflow method made the heart open. It was determined how thick the interventricular septum, right ventricle wall, and left ventricle wall were. Each valve's number, degree of stenosis, and amount of calcification were examined. We tracked the location and extent of regions where myocardial ischaemia had occurred recently or in the past. Serial sections were obtained every 4 to 5 millimeters to examine the right circumflex coronary artery, left anterior descending artery, and right coronary artery. We looked at aortic dilatation, thickness, and atheromatosis.

Microscopic examination

Atrioventricular junction (right and left), ventricular walls (left and right), interventricular septum, apex, and coronary arteries (both left and right) were also included in the collection of sections. In addition, we took samples from areas that we suspected of having a pathogenic nature. Regular Hematoxylin and Eosin were used to stain all sections before they were examined using a light microscope with 10x and 40x lenses. A record was made of the staining results.

Results

The current investigation included 62 cardiac specimens. The age range of the patients in our collection was 13-89. The age bracket of 51–60 years had the highest case count. A total of 42 males and 20 females (or 67.74% and 32.26% respectively), Males were much more numerous than females (Table 1).

Table 1: Sex wise distribution of cases.

Gender	Number of patients	Percentage
Male	42	67.74%
Female	20	32.26%

Atherosclerosis was the most often seen finding in histological evaluations (Figure 1) There were 35 instances, myocarditis (Figure 2), 3 cases (4.83%), pericarditis 2 cases (3.22%), there were 8 cases of myocardial infarction (12.9% of the total) (Figure 3, 4). Hypertrophy (11.29%), Figure 5. Both the gross and microscopic examinations failed to reveal any particular pathological abnormalities in 8 instances (12.9%).

Table 2: finding of histological sections.

Histopathological finding	Number of cases	Percentage
Atherosclerotic plaque	35 P	56.45%
MI	8 P	12.9%
Pericarditis	2 P	3.22%
Myocarditis	4 P	4.83%
Hypertrophy of cardiac muscle	7 P	11.29%
No specific finding	8 P	12.9%
total	62 P	100%

A total of 35 instances were found to have atherosclerotic alterations; of these, 25 (40.32%) had plaque calcification and 4 (6.45%) had thrombus development on top of it.

Out of 8 cases of myocardial infarction, 5 cases showed old infarct, whereas 2 cases revealed recent infarct (Table 3).

In order to comprehend the fundamental mechanism that causes clinically severe atherosclerotic cardiovascular disease, the autopsy investigation is useful. Selecting a representative sample from the live population is not possible using any reliable technique. Consequently, it was thought that the ideal way to investigate cardiovascular disorders is to find a sample of the live population that has died from what is likely a cardiovascular pathology-related cause.

Table 3: Types of myocardial infarction (out of 8).

MI	Number of cases
Recent MI	2
Old MI	6
Total	8

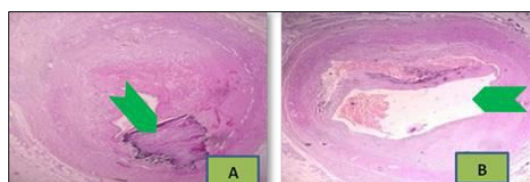


Fig 1: Atherosclerosis A) with medial calcification B) with recanalization (H and E X 400).

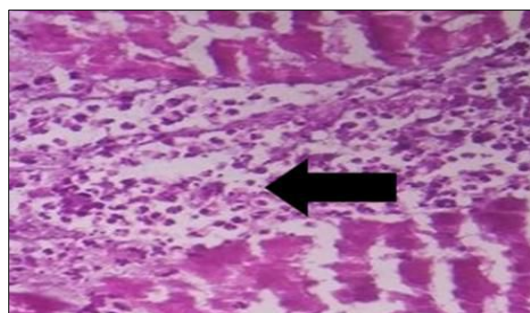


Fig 2: Acute inflammatory infiltrate in myocarditis (black arrow) (H and E X 200).

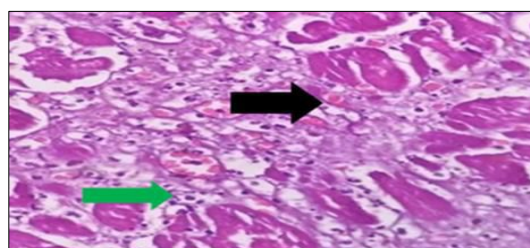


Fig 3: Acute myocardial infarction (H and E X 400) with inflammatory infiltration (green arrow) and neovascularization (black arrow).



Fig 4: Old myocardial infarct (H and E X 400).

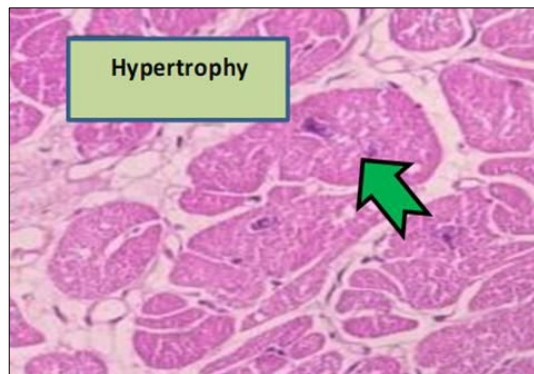


Fig 5: A close-up of the enlarged myocardial fibers (H and E X 200).

Discussion

Deaths from cardiovascular causes were more common among participants aged 41 to 60 in this research. Rodgers *et al.* [2019] [8] and Tian [2023] [7] both observed similar results. Age is clearly one of the most significant risk factors for cardiovascular disease [7, 8].

The risk of atherosclerosis develops dramatically from a young age until about the age of 65.

Men made up 76% of the sample and females 24%. This further proves that men have a higher chance of developing heart disease than women [9].

The histological examination revealed coronary atherosclerosis in 35 individuals, or 56.45% of the total. Consistent findings were seen by Li *et al.* (59%). 10. In a total of 25 patients (40.32%), calcification was found, and in 4 instances (6.45%), thrombus was found. Similarly, 4.8% of patients were reported to have thrombosis by Palsoe *et al.* 11.

Lesions that develop in the second and third decades of life may have less extensive plaque calcification than lesions that have progressed further along in the course of a person's life. Histopathological investigations have shown that microscopically mineralized plaques are larger. However, the relationship between arterial calcification and the risk of plaque rupture is not well understood.

Eight patients, or 12.9%, in this research had myocardial infarction confirmed histologically; similarly, 26 instances were reported by Lynge *et al.* 6. Our investigation did not find myocardial infarction in as many patients as Gerull. (40.2%). 13. Compared to the current investigation, Tian, *et al.* only documented ischemic heart disease in 9% of patients. 7. Since microscopic characteristics rely on the time interval between the start of ischaemia and death, this discrepancy can be because of the temporal fluctuation between the two.

Myocardial hypertrophy was the second most prevalent lesion in our investigation, occurring in 5 instances (8.06%).

Two previous studies, one by Nadziakiewicz *et al.* and the other by Tabbah *et al.*, both showed a 7% incidence. 5.14. A significantly greater incidence of heart hypertrophy was recorded in 66% of patients by Salzillo Karanfil *et al.*

In 3 patients (4.83%), myocarditis was detected. Myocarditis percentages have been reported by several writers, As Ocana *et al.* accounted for 7%.

While just 0.86% of patients were described by Căținaș *et al.* as having pericarditis, 17. while 3.22% of cases in the current research had this condition. Most cases of pericarditis are related to infection and seldom occur on their own. In most cases, viruses are to blame.

The leading cause of unexpected death is cardiovascular illness. Although the present Framingham risk assessment is not ideal, it is well-known that some people may lower their risk of cardiac events by changing their lifestyle and taking medication. 18

Because of this, medicolegal autopsies advocate for a multidisciplinary approach that includes taking samples from every organ imaginable for histopathological analysis as well as reviewing the patient's medical history, biochemistry, microbiology, toxicology, and scene of the crime. Forensic surgeons rely heavily on histopathology of different organs when trying to determine the cause of death.

Conclusion

Ischemia of the heart muscle caused by atherosclerosis was the leading cause of mortality in this investigation. For a more precise picture of cardiovascular disorders in humans, histopathological investigations are important. Improved treatment and future results for cardiovascular disease patients are possible with a deeper knowledge of disease biology and the introduction of innovative therapies.

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