

An Autopsy Study of Histomorphological Changes in Heart: A 3-Year Study at A Tertiary Care Hospital, Government Medical College, KadapaV Nagesh Kumar¹, K Divija², G Sobha Rani³, B Sridhar Reddy^{4*}¹Assistant Professor, Department of Pathology, Government Medical College, Kadapa²Assistant Professor, Department of Pathology, Government Medical College, Kadapa³Professor, Department of Pathology, Government Medical College, Kadapa⁴Professor, Department of Pathology, Rangaraya Medical College, Kakinada

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Conflict of interest: Nil

Abstract:

Introduction and Objectives: Sudden cardiac deaths related to cardiovascular diseases accounts for nearly 50% of sudden deaths, most of which are caused by coronary artery disease. Incidence of ischemic heart disease in India has increased to about 10%, with more advanced lesions at younger age than in other ethnic groups. Aim of the present study is to identify various histo-morphological lesions in coronaries, aorta and heart.

Material & Methods: This is a retrospective study over a period of 3 years from August 2020 to July 2023. A total number of 266 autopsy specimens were received in the department of pathology, GMC, Kadapa, out of which 110 heart specimens were received. 23 heart specimens were autolysed which were excluded and the remaining 87 were included in the study.

Results & Conclusion: 87 heart specimens with preserved morphology were included in the study. The most common morphological change in heart was left ventricular hypertrophy (LVH). The pathological lesions in coronaries were seen in 49 cases (56%) with maximum lesions observed in LAD – 19 cases (39%). Coronary atherosclerosis was further graded according to Modified AHA classification based on histo-morphological description. To conclude our study highlights the importance of histopathological autopsies of heart which can provide important clues that aid in concluding the cause of sudden deaths and also provides estimation of undiagnosed cases and assessment of prevalence of atherosclerosis.

Key words: Pathological autopsy, Coronaries, Aorta and Heart.

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Introduction

Sudden cardiac deaths related to cardiovascular diseases accounts for nearly 50% of sudden deaths, most of which are caused by coronary artery disease [1]. Incidence of cardiac deaths has few been increasing in the last few decades, predominantly in the urban population. Incidence of ischemic heart disease in India has increased to about 10% [2,3] with more advanced lesions at younger age than in other ethnic groups [4]. The inability to determine the cause of sudden death in a previously healthy person is one of the challenges faced by forensic experts [5]. The pathological autopsies can aid in determining the cause of sudden death by histo-morphological studies and also serve as a valuable tool in identifying cause of the disease.

Aim

Aim of the present study is to identify various histo-morphological lesions in coronaries, aorta and heart.

Materials & Methods

This is a retrospective study over a period of 3 years from August 2020 to July 2023. A total number of 266 autopsy specimens were received in the department of pathology, GMC, Kadapa, out of which 110 heart specimens were received. 23 heart specimens were autolysed which were excluded and the remaining 87 were included in the study.

Gross Examination of Heart

The heart was fixed in 10% Neutral buffered formalin solution and was grossly examined for macroscopic lesions. The heart was weighed and the external measurements taken followed by Inflow-Outflow dissection method (Vichow's Method).

The thickness of walls of Right and Left atrium and ventricles were measured. Circumference of Mitral, Tricuspid, Pulmonary and Aortic valves were noted. Left coronary arteries (Left anterior descending (LAD), Left Circumflex artery (LCA)

and Right coronary artery (RCA) were sectioned at 3 mm intervals for pathological lesions such as thrombus, Stenosis, Calcifications, Atherosclerosis. Aorta was grossly examined for fatty streaks and Atherosclerotic plaques. Sections were submitted from walls of four chambers of heart, coronaries and Aorta. Additional sections were taken wherever necessary. Tissues were processed and subjected to paraffin embedding. Sections of 4-5 microns were cut by rotary microtome and stained with routine Hematoxylin and Eosin method. Microscopic examination was done to identify various pathological lesions. Grading of coronary atherosclerosis was done using Modified American Heart Association (AHA) classification of atherosclerosis (Table 1).

Observations & Results

The present study comprised of 266 autopsies, out of which 110 were heart specimens (41%). Among these 23 were completely autolysed and 87 heart specimens with preserved morphology were studied (79%). In our study, youngest age being 16 years and oldest age 82 years. Out of 87 cases 75(86%) were males and 12(14%) were females. There was remarkable Male predominance with a Male to Female ratio of 6:1. In our study, the

maximum number of cases presented in the age group 41-60 years (28%). The most common morphological change in heart was left ventricular hypertrophy (LVH) in 46 cases (53%), which were common in age group of 31-40 years. In our study, a case of Tuberculosis myocarditis was seen in a 55 year old female, AFB stain was positive (Fig-5). Morphological changes in aorta (Fig-6) was seen in 22 cases (25%), out of which 15 cases (68%) showed fatty streaks (Fig-7) and the remainder atherosclerosis 7 cases (32%). The maximum number of lesions in aorta was seen in age group 31-50 years. In our study pathological lesions in coronaries were seen in 49 cases (56%) with maximum lesions observed in LAD – 19 cases (39%) (Table-2). Dual artery lesions (both Right & Left coronaries) were involved in 13 cases (27%), with maximum number of cases observed in age group of 41-50 years. (Fig-8). Coronary atherosclerosis was further graded according to Modified AHA classification based on histomorphological description (Table-3). In our study out of 49 coronaries fibrous cap atheroma was the most common morphological grade seen in 14 cases (29%) followed by thin fibrous cap atheroma in 12 cases (24%) (Fig-9).

Table 1: Modified American Heart Association (AHA) classification of atherosclerosis based on morphological description

	Description	Thrombosis
Non-atherosclerotic lesions		
Intimal thickening	The normal accumulation of Smooth Muscle Cells (SMCs) in the intima in the absence of lipid or macrophage foam cells	Absent
Intimal xanthoma, or "fatty streak"	Luminal accumulation of foam cells without a necrotic core or fibrous cap. Based on animal and human data, such lesions usually regress.	Absent
Progressive atherosclerotic lesions		
Pathological intimal thickening	Pathological intimal thickening SMCs in a proteoglycan-rich matrix with areas of extracellular lipid accumulation without necrosis	Absent
Erosion	Luminal thrombosis; plaque same as above	Thrombus mostly mural and infrequently occlusive
Fibrous cap atheroma	Well-formed necrotic core with an overlying fibrous cap	Absent
Erosion	Luminal thrombosis; plaque same as above; no communication of thrombus with necrotic core	Thrombus mostly mural and infrequently occlusive
Thin fibrous cap atheroma	A thin fibrous cap infiltrated by macrophages and lymphocytes with rare SMCs and an underlying necrotic core	Absent; may contain intraplaque hemorrhage/fibrin
Plaque rupture	Fibroatheroma with cap disruption; luminal thrombus communicates with the underlying necrotic core	Thrombus usually occlusive
Calcified nodule	Eruptive nodular calcification with underlying fibrocalcific plaque	Thrombus usually nonocclusive
Fibrocalcific plaque	Collagen-rich plaque with significant stenosis usually contains large areas of calcification with few inflammatory cells; a necrotic core may be present.	Absent

Table 2: Site wise distribution of lesions in coronaries

Site	Atherosclerosis	Thrombus	Monkeberg medial calfic sclerosis	Total cases
RCA	3	2	7	12
LCA	3	2	0	5
LAD	14	4	1	19
Dual arteries (Right & Left coronaries)	8	3	2	13

Table 3: Grading Coronary atherosclerosis according to Modified AHA classification based on histomorphological description

Lesions	LAD	LCA	RCA	Both coronaries	TOTAL
Intimal thickening	2	0	1	1	4
Intimal xanthoma	4	1	1	1	7
Progressive intimal thickening	2	1	1	1	5
Fibrous cap atheroma	7	1	3	3	14
Thin fibrous cap theroma	3	2	2	5	12
Calcified Nodule	1	0	2	1	4
Fibrocalcific nodule	0	0	2	1	3
TOTAL	19	5	12	13	49

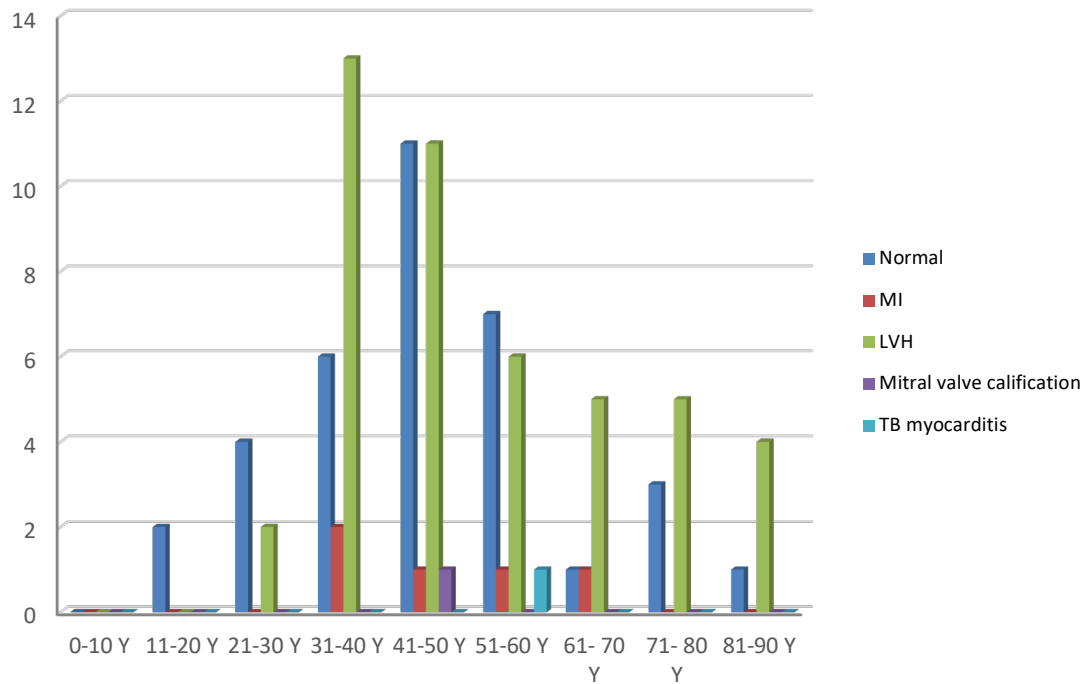


Figure 1: Age wise distribution of morphological changes in Heart

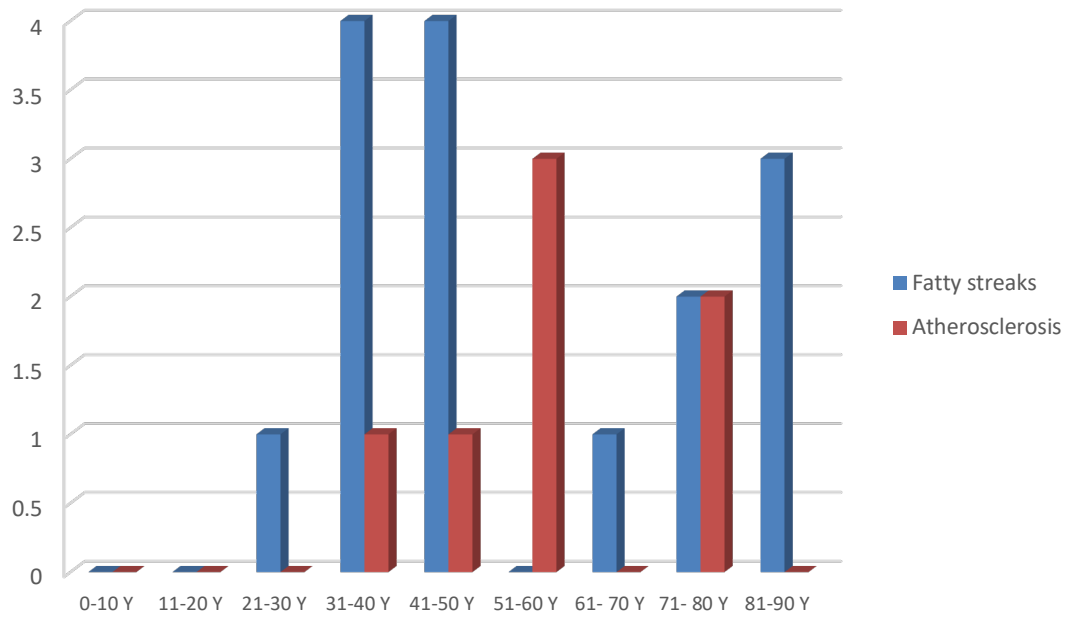


Figure 2: Age wise distribution of morphological changes in Aorta

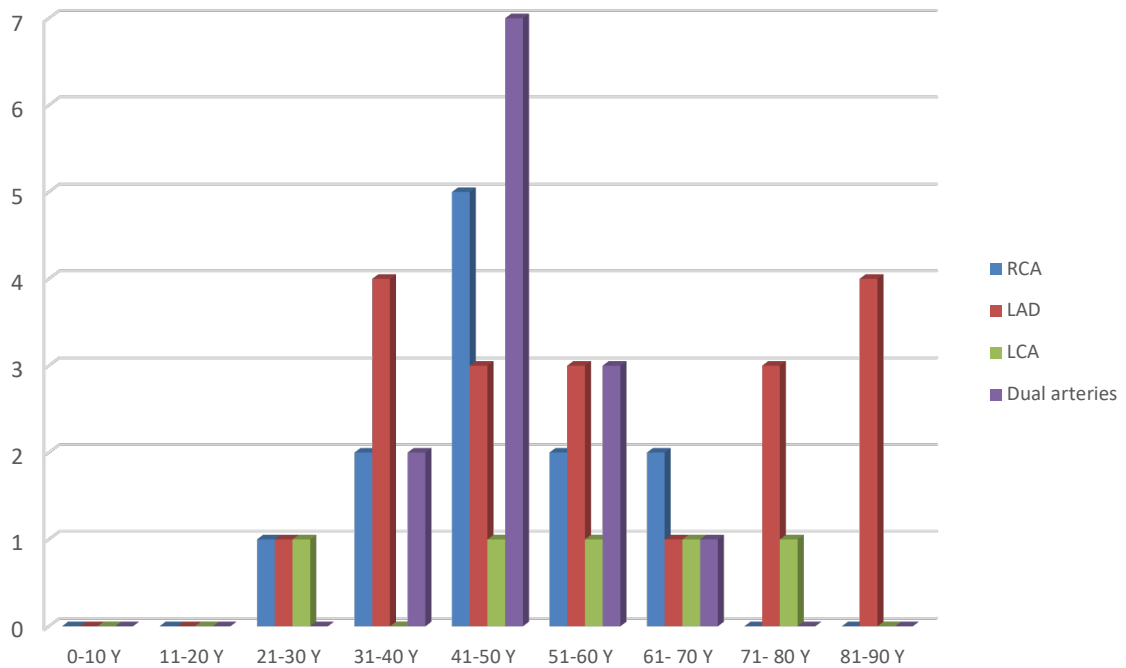


Figure 3: Age wise distribution of cases in coronaries

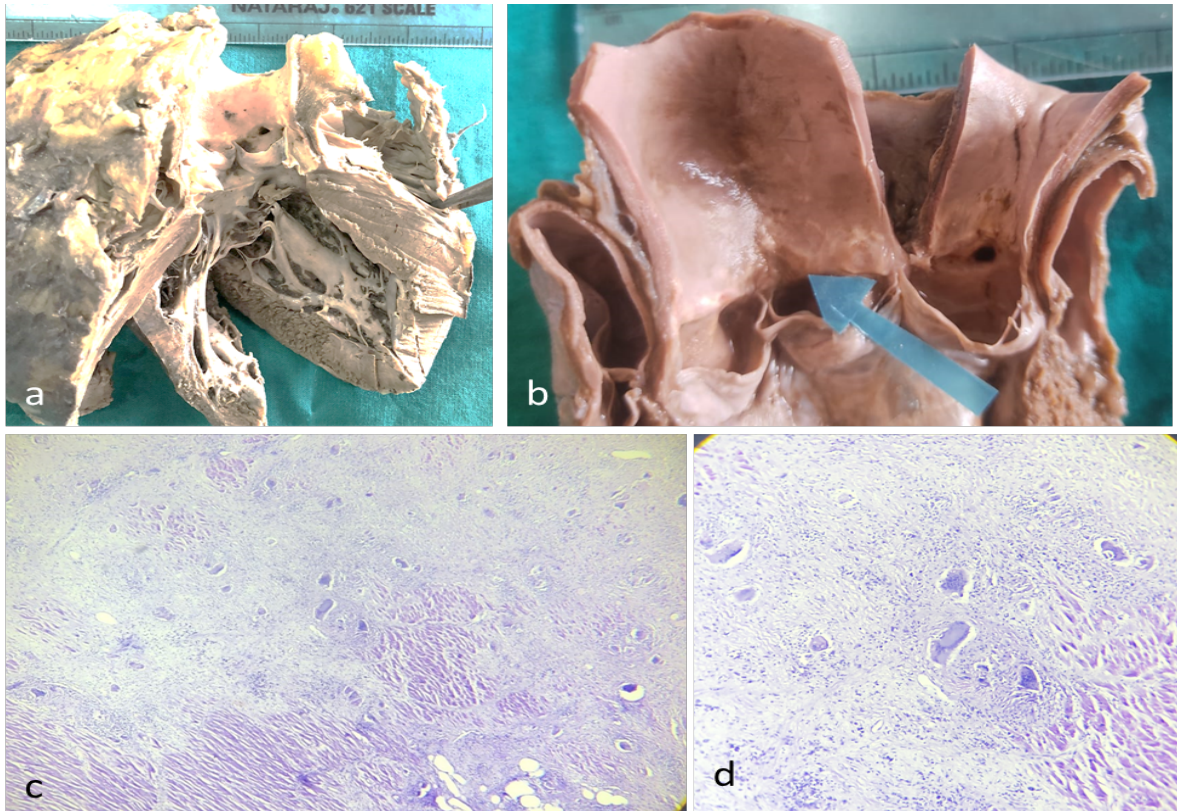


Figure 4: a.Gross – Hypertrophy of Left ventricle. b. Gross -Aorta showing fatty streaks. c & d. Shows well-formed granulomas consisting of Langhan’s and foreign body type of multinucleate giant cells along with epithelioid cells, macrophages and Lymphocytes along with caseous necrosis. (c-Scanner view, d – 40x, H&E).

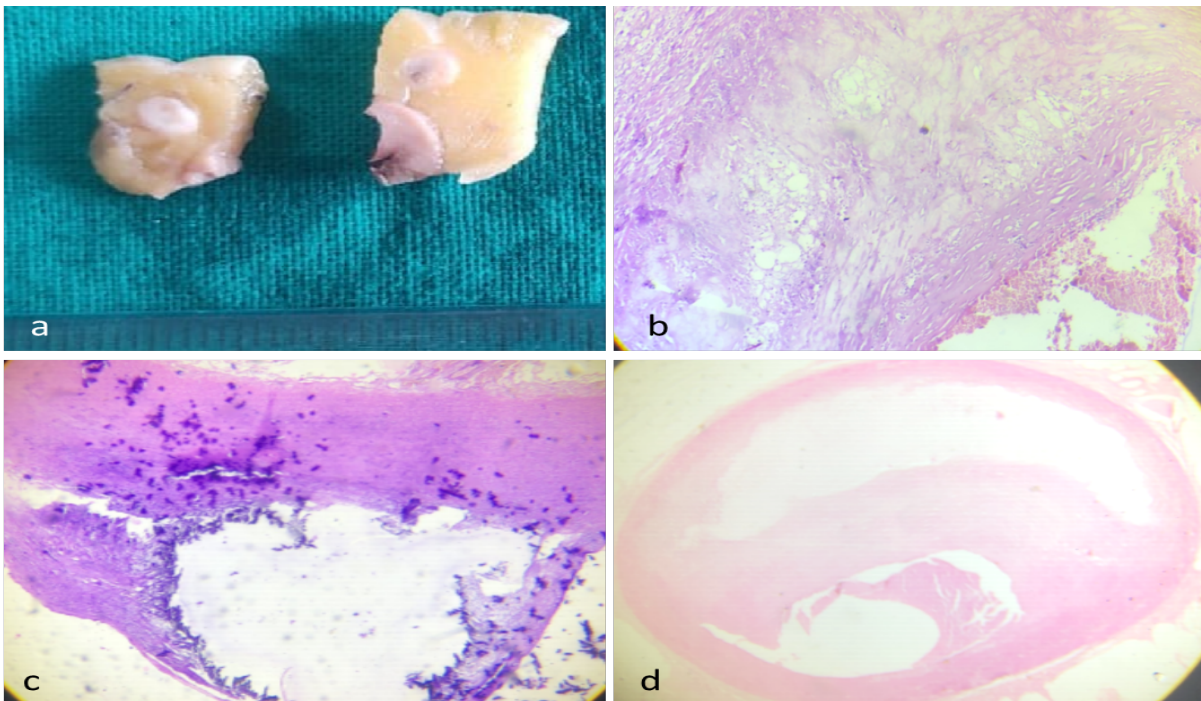


Figure 5: Atherosclerosis. a. Gross- Both the coronaries show complete obstruction of the lumen. B. Coronary-Thin fibrous cap atheroma: shows thin fibrous cap infiltrated by foamy macrophages and extracellular lipid (40x H&E). c. Aorta - Calcific nodule showing eruptive nodular calcification with underlying fibrocalcific plaque (20x H&E). d. Coronary artery - Fibrous cap atheroma with erosion showing inclusions mural thrombus (20x H&E).

Discussion

As nearly 50% of sudden deaths are related to cardiovascular diseases, keeping this in mind the cardiac autopsies were performed to observe histomorphological changes that could help in reaching the etiological cause of death. In this present study the total of 87 heart autopsies were performed with preponderance of male cases (75 cases, 86%). This similar observation was seen in Shah Saloni N et al (92.76%) [6], Viral M. Bhanvadia et al (64%) [7], Shilpa Garg et al (76%) [5], proving that males were at higher risk of developing cardiovascular diseases.

In this present study it was observed that commonest age group affected were 41-50 years which is similar to studies done by Shilpa Garg et al (41-60 years), Viral M. Bhanvadia et al (40-49 years) Joshi C et al (41-60 years) [8] reflecting that younger adult groups are at higher risk. In our study myocardial hypertrophy of left ventricular wall thickness ranged from 1.8 cm to 2.0 cm, seen in 46 cases (53%). This was comparable with studies by Joshi C et al (52%) and Karanfil R et al (66%) [9]. Tuberculosis is a very rare cause of Myocarditis with a very low prevalence ranging from 0.4 -2%. It is mostly asymptomatic, but can even present with sudden cardiac arrest [10], which is most often diagnosed at post-mortem [11]. In our study we received a case of tuberculous myocarditis in a 55 year old female (1.1%).

In our study aorta showed involvement with fatty streaks in 15 cases (68%) and atherosclerosis in 7 cases (32%). Maximum number of fatty streak cases was seen in age group of 31-50 years and aortic atherosclerosis cases were seen in 51-60 years which was comparable to studied done by Siddiqui, et al [12] who reported maximum number of aortic atherosclerosis in the age group of 31-40 years. Coronary artery disease has multi factorial risks like sedentary life style, alcohol and tobacco abuse, cholesterol rich dietary habits and emotional stress. In our study a total of 49 cases (56%) had coronary atherosclerosis which is comparable to studied like Shilpa Garg et al (55.3%), Shah Saloni et al (61%) and Joshi C et al (64%). In this present study LAD was most common artery involved with atherosclerosis (39%) which is in concordant with studied like Shah Saloni et al (38.7%), Viral M. Bhanvadia et al (42%) and Naher S et al (47%) [13]. our study showed that dual arteries (Right and Left coronaries) involvement seen in 13 cases (27%) seen in the age group of 41-50 years.

Conclusion

To conclude, our study highlights the importance of histopathological autopsies of heart which can provide important clues that aid in concluding the

cause of sudden deaths and also provides estimation of undiagnosed cases and assessment of prevalence of atherosclerosis. The limitation of the present study is a smaller sample size and it is recommended to include a larger sample size.

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