

Histopathological Study of Cardiac Lesions in Medicolegal Autopsies

Medha P. Kulkarni¹, Kalpana R. Sulhyan², Nayan A. Ramteerthakar³

Abstract

Context: Cardiovascular diseases are an important cause of morbidity and mortality in both developing and developed countries. The prevalence of coronary artery disease has doubled in Indians during the past three to four decades. Hence, the study was undertaken to evaluate the prevalence of various heart diseases in this region of western Maharashtra. *Aim:* The aim was to assess the pattern and prevalence of atherosclerosis involving the coronary arteries and to study the gross and microscopic features of various lesions affecting the valves, myocardium, endocardium and pericardium. *Design:* This was a prospective analytical study. *Material and methods:* The study included 250 complete heart specimens of medicolegal autopsy cases received from August 2012 to July 2014. Thorough gross examination of atria, ventricles and valves was done followed by examination of the coronary arteries and representative tissue bits were submitted for microscopy. *Results:* Atherosclerosis was the most common lesion involving 123 cases with 48 cases of triple vessel disease. Ischemic heart disease was seen in 62 cases, 60 being associated with atherosclerosis. Fourteen cases of left ventricular hypertrophy, nine cases of valvular heart disease, three cases each of cardiomyopathy and disseminated intravascular coagulation, two cases of acute leukemia and one case each of papillary fibroelastoma, amyloidosis, ventricular septal defect and sickle cell anaemia were observed. *Conclusion:* Present study emphasizes the role of atherosclerosis in ischemic heart disease. Amyloidosis and rare tumors like papillary fibroelastoma of the heart can be accurately diagnosed on histopathology underscoring the usefulness of an autopsy based study.

Keywords: Atherosclerosis; Ischemic Heart Disease; Valvular Heart Disease.

Introduction

Cardiovascular diseases have emerged as a major health problem worldwide with atherosclerosis being the major cause [1]. However, study of atherosclerosis in the living population is difficult, invasive and expensive. An autopsy based study gives a good measure of the prevalence, grading and distribution pattern of atherosclerotic lesions. Valvular heart diseases especially Rheumatic heart disease (RHD) continues to be an important cardiac problem even today. Heart is also involved in a variety of systemic diseases. Hence the study was

undertaken on medicolegal autopsies to evaluate the prevalence of various heart diseases in this region of western Maharashtra.

Material and Methods

250 specimens of complete heart from medicolegal autopsies were studied over the period of two years from August 2012 to July 2014. The specimens were fixed in 10% formalin. The heart was examined externally to assess the size, weight, scars if any and status of coronary vessels was noted. Gross photographs of the lesions were taken. Then the heart was opened by the flow of blood method. Bread loaf technique was employed for myocardial infarction [2].

After opening the heart, atria and ventricles were thoroughly examined. Condition of heart valves, thickness of cusps and calcification if any were recorded. The right and left coronary arteries, left anterior descending artery and left circumflex artery were examined for atherosclerosis, presence of any thrombus or aneurysmal dilatation.

Author's Affiliation: ^{1,3}Associate Professor ²Professor and Head, Department of Pathology, Govt. Medical College, Miraj, Maharashtra 416410, India.

Corresponding Author: Medha P. Kulkarni, Associate Professor, Department of Pathology, Govt. Medical College, Miraj, Maharashtra 416410, India.

E-mail: mpkulkarni17@gmail.com

Received on 31.01.2018, Accepted on 26.02.2018

Tissue bits were taken from left ventricle, right ventricle, coronary arteries and interventricular septum. Additional bits were taken from any gross pathological lesion found. Fixation was done in 10% Formalin followed by routine tissue processing. Sections were stained with haematoxylin and eosin. Special stains were employed wherever necessary. Microscopic findings were correlated with gross features.

Results

The total number of heart specimens received was 300. In 41 cases, only part of the heart was received while in nine cases, it was completely autolysed. Excluding these 50 cases, total 250 specimens of heart along with root of aorta were studied.

The age ranged from less than one year to 90 years. Total number of males was 155 (62%) and females 95 (38%) giving M: F ratio of 1.63: 1. (Table 1)

The various lesions encountered are shown in table 2. The most common lesion was atherosclerosis involving coronary arteries in 123 out of 250 cases (49.2%), affecting 103 males and 20 females (M:F = 5.15:1). No specific lesion was found in 91 (36.4%) cases.

Typing of atherosclerosis was done according to the classification provided by the American Heart Association [3]. In this classification, atherosclerosis is divided into six types, initial lesions including type I and II, intermediary lesion corresponding to type III, advanced lesions including type IV and V and complicated lesions consisting of type VI. Atherosclerosis involving the coronary arteries was

seen in total 123 cases (49.2%). The most commonly involved vessel was Left anterior descending (LAD) coronary artery accounting for 103 out of 123 (83.74%) cases followed by right coronary artery (RCA) in 80 (65.04%) and left circumflex coronary artery (LCX) in 75 (60.97%) cases. The predominant type of atherosclerosis involving coronary arteries was type V seen in 55 cases (44.71%) followed by type III in 21 cases (17.07%), type IV in 18 cases (14.63%), type VI in 16 cases (13.08%), type II in ten cases (8.13%) and type I in three cases (2.43%). Triple vessel disease accounted for the maximum number of cases, 48 out of 123 (39.02%), followed by double vessel involvement in 39 cases (31.70%) and single vessel involvement in 36 cases (29.26%). Intraluminal thrombus in association with atherosclerosis was seen in 14 cases, ten in LAD and four in LCX. It was occlusive in a single case of LAD.

Spectrum of Ischemic heart disease (IHD) included acute myocardial infarction (AMI), chronic ischemic heart disease (CIHD) and acute co-existing with chronic ischemic heart disease. On microscopy, AMI showed necrosis of myocardial fibers, heavy neutrophilic infiltrate and hemorrhage while CIHD included scars representing old healed myocardial infarcts and small foci of replacement fibrosis [1]. In cases with coexistent AMI and CIHD, histopathological features of both were seen. IHD was seen in 62 out of 250 cases affecting 56 males (90.32%) and six females (9.68%). Out of these 62, coronary atherosclerosis was seen in 60 cases. Two cases of IHD did not show atherosclerosis. Maximum number of IHD, 34 out of 62, was observed in triple vessel disease. Prevalence of atherosclerotic involvement of coronary vessels and their relationship with ischemic heart disease is shown in Table 3.

Table 1: Age and sex incidence of cases

Age group (years)	Males	Females	Total	Percentage (%)
<1 Year	3	2	5	2
1-10	3	3	6	2.4
11-20	4	16	20	8
21-30	24	51	75	30
31-40	42	9	51	20.4
41-50	29	6	35	14
51-60	25	4	29	11.6
61-70	17	1	18	7.2
71-80	8	0	8	3.2
81-90	0	3	3	1.2
Total	155	95	250	100

Table 2: Various pathological lesions found in hearts & their prevalence

Sr.No.	Pathology	No of Lesions (%)
1	Atherosclerosis involving coronary arteries	123 (49.2%)
2	Ischemic heart disease	62 (24.8%)
3	Soldier's plaque	23 (9.2%)
4	Left Ventricular hypertrophy	14 (5.6%)
5	Valvular heart Disease	09 (3.6%)
6	Cardiomyopathies	03 (1.6%)
7	Tumors of the Heart	01 (0.4%)
8	Systemic diseases involving the heart	7 (2.8%)
9	No Specific lesion	91 (36.4%)

In IHD, left ventricle (LV) was involved in total 40 cases. In 18 cases, only LV was involved while in 22 cases, LV was involved along with interventricular septum (IVS), apex or right ventricle.

Isolated left ventricular hypertrophy (LVH) was seen in 14 cases, affecting 13 males and one female. History of hypertension was available in eight of these cases.

Nine cases of valvular heart disease, six suggestive of healed rheumatic heart disease (RHD), two cases of acute infective endocarditis and one case of prosthetic mitral valve thrombosis were observed. In three cases, cardiomyopathy was suspected, hypertrophic cardiomyopathy in two cases and dilated (Peripartum) cardiomyopathy in one case.

We also had one case of perimembranous ventricular septal defect (VSD) in a 25 days old female child. One case of papillary fibroelastoma (PF) involving the mitral valve was encountered. Grossly, tiny warty excrescences were seen attached to the valve cusps. Microscopy confirmed PF.

Soldier's plaque was seen in 23 cases affecting 20 males and three females. In 12 cases, the plaque was situated on the anterior surface of the LV, in six cases on the anterior surface of RV and in five cases on the posterior surface of LV.

Systemic diseases we came across were three cases of disseminated intravascular coagulation (DIC), two cases of acute leukemia and one case each of systemic amyloidosis and sickle cell anemia.

Discussion

In the present study of 250 complete heart specimens, the most common lesion encountered was atherosclerotic coronary artery disease involving 123 out of 250 cases, with a prevalence of 49.2%. Similar findings have been reported by Marwah et al (71%), Dhruv et al (23.3%) and Shiladeria et.al (46%) [4,5,6]. The order of involvement of coronary arteries in descending frequency was LAD (103 cases, 83.74%), RCA (80 cases, 65.04%) and LCX (75cases, 60.97%). Jha et al have reported the frequency of coronary vessel involvement as LAD 33%, RCA 29% and LCX 15% while Garg et al reported LAD 38.1%, RCA 35.1% and LCX 34.1% [7,8]. Table 4 depicts comparison of our findings with other authors.

Type V atherosclerosis was the most common type involving the coronaries accounting for 55 out of total 123 cases (44.71%), LAD in 31, LCX in 14 and RCA in ten cases. Type VI atherosclerosis accounted for 16 cases (13.08%) which included two cases of plaque rupture in LAD and 14 cases of thrombi. Out of 14, in ten cases the thrombi were in LAD and in four cases, in LCX. Jha et al have also reported type V & type VI atherosclerosis as the most common types [7]. Marwah et al, Dhruva et al, Garg et al and Agravat et al have also reported similar findings [4,5,8,9]. Triple vessel involvement was most common, noted in 48 out of 123 cases (39.02%) followed by double vessel involvement in 39 cases (31.70%) and single vessel involvement in 36 cases (29.26%).

Table 3: Prevalence of atherosclerotic involvement of coronary arteries and their relation with ischemic heart disease

Sr. No.	No. of coronary vessels involved	No. of cases	CIHD (39)	AMI (11)	AMI with CIHD (12)
1	No atherosclerosis	2	0	1	1
2	Single vessel disease	12	5	0	0
3	Double vessel disease	14	14	4	3
4	Triple vessel disease	34	20	6	8

CIHD - Chronic Ischemic Heart Disease

AMI - Acute Myocardial Infarction

Table 4: Comparison of coronary involvement by different authors.

Coronary vessel involved	Dhruva et al [5]	Jha et al [7]	Garg et al [8]	Agravat et al [9]	Present study
LAD	60%	33%	38.1%	40%	83.74%
RCA	50%	29%	35.1%	32%	65.04%
LCX	42%	15%	34.1%	30%	60.97%

We had 62 cases (24%) of IHD affecting 56 (90.32%) males and six (9.68%) females. Majority of cases were in the age group 51-60 years (15 cases, 24.19%). Out of 62, atherosclerosis involving any one or more of the three major coronary arteries was seen in 60 cases while in two cases of IHD, one AMI and other CIHD, all the coronary arteries were normal.

In the spectrum of IHD, maximum number was CIHD with 39 cases (62.91%). Acute MI contributed 11(17.74%) and combined AMI with CIHD 12 cases (19.35%). Marwah et al reported an incidence of 51 out of 200 (70.83%) for CIHD, 14 (19.44%) for AMI and seven cases (9.72%) for combined AMI & CIHD [4].

Out of 48 cases of triple vessel disease, 34 showed IHD with CIHD in 20 cases, AMI in six and combined AMI with CIHD in eight cases. Hence out of total 62 cases of IHD, 34 (54.83%) were seen in triple vessel disease, highlighting the strong association of triple vessel disease with IHD. Marwah et al and Jha et al have reported similar findings [4,7].

Intraluminal thrombus in association with atherosclerosis was seen in 14 cases, ten cases in LAD and four cases in LCX. In a single case involving LAD, it was occlusive. Myocardial lesions in these cases were CIHD in six, combined CIHD and AMI in four and AMI in four cases. Marwah et al reported thrombosis in 13 cases, 11 involving LAD and two involving RCA [4].

In present study, IHD with involvement of LV alone was seen in 18 out of 62 cases (29.03%) while LV and IVS combined in seven cases (11.29%). Marwah et al have reported involvement of LV alone in 15 out of 72 cases (20.83%) while LV and IVS combined in eight cases (11.11%) [4].



Fig. 1: Gross photograph showing rupture of anterolateral wall of left ventricle following acute myocardial infarction.

In two cases, rupture of the anterolateral wall of LV was seen as a complication of AMI. Both were males with triple vessel disease. (Figure 1)

We encountered 23 cases of Soldier's plaque, 20 in males and three in females. The plaque was whitish rough area ranging in size from 1- 2.5 cms and was situated on the anterior surface of the LV in 12 cases, on the anterior surface of RV in six cases and on the posterior surface of LV in five cases. Microscopically, the pericardium showed collagen deposition and mononuclear cell infiltration.

We had 14 cases of isolated LVH affecting 13 males and one female. History of hypertension was available in eight cases. The LV wall thickness varied from 1.8 to 2.2 cm. One case of LVH also showed acute infective endocarditis affecting the aortic valve with large friable vegetations.

There were nine cases of valvular heart disease, six suggestive of healed RHD, two cases of acute infective endocarditis and one case of prosthetic mitral valve thrombosis. Mitral valve was involved in all six cases of RHD while in two cases, aortic valve was involved additionally. Typical fish mouth appearance of mitral orifice with fusion of chordae tendinae and dilatation of left atrium was seen in two cases. Microscopically, valve leaflets showed fibrosis and neovascularization. However, Aschoff bodies were not seen in any of the cases. One case of prosthetic mitral valve showed a thrombus completely occluding the mitral orifice. Marwah et al observed two cases of RHD out of total 200 cases [4].

Two cases of acute infective endocarditis (IE) were seen, one involved the tricuspid valve in a 14 year old girl. Unfortunately details of this case were not available. The other case was a 30 year old male with large friable vegetations on the aortic valve. Concentric LVH with foci of CIHD were also seen in this case.

In three cases, cardiomyopathy was suspected; hypertrophic cardiomyopathy in two cases and dilated (Peripartum) cardiomyopathy in one case. Both the cases of hypertrophic cardiomyopathy were young, one 23 years male and the other 32 years female with history of sudden death. On gross examination, the heart was enlarged with mean weight of 400 gms and IVS thickness of 3.3 cm in one and 3.5 cm in other. The left ventricular cavity was banana shaped and revealed a distinct subaortic bulge. Microscopy in both the cases showed myofibre disarray with marked myocyte hypertrophy, nuclear enlargement and pleomorphism, interstitial fibrosis and luminal narrowing of intramural coronary arteries [5].

Peripartum cardiomyopathy (PCM) is a type of dilated cardiomyopathy which develops during the last trimester or within first six months after pregnancy. In our study, we had one case of a 27 years female with 30 weeks gestation with clinical and echocardiographic diagnosis of PCM. On gross examination all four chambers of the heart appeared dilated. Microscopy revealed focal myocyte hypertrophy, interstitial fibrosis and mononuclear inflammatory infiltrate.

All three cases of DIC were postpartum females with a clinical diagnosis of DIC. The myocardium showed focal haemorrhages. Fibrin thrombi were seen in the blood vessels of myocardium, pericardium, lungs and kidneys.

PF is an endocardial based papilloma lined by endocardial cells with proteoglycan rich avascular stroma. It is a rare benign tumor accounting for less than 10% of primary cardiac tumors and is almost always detected incidentally. Sporadic cases are most common on the cardiac valves while iatrogenic tumors tend to occur in a variety of non-valvular endocardial surfaces [10]. We had one case of PF in a 24 years female affecting the mitral valve which showed tiny warty excrescences on both the cusps. Microscopy confirmed PF (Figure 2).

The only case of VSD in our study was a 25 days female child with a perimembranous VSD with a diameter of 1.3 cm.

A single case of sickle cell anemia was observed in a 38 year old female. Blood vessels of the myocardium, kidney and lungs showed sickled red blood cells in the lumina.

Heart can be involved in any form of systemic amyloidosis. In our case, the heart was enlarged weighing 420 gms and all the coronaries appeared thickened. Microscopically, amyloid deposits were seen in the subendocardium, myocardium, walls of coronary vessels and pericardial fat. (Figure 3) Kidney and spleen also showed amyloid deposits.

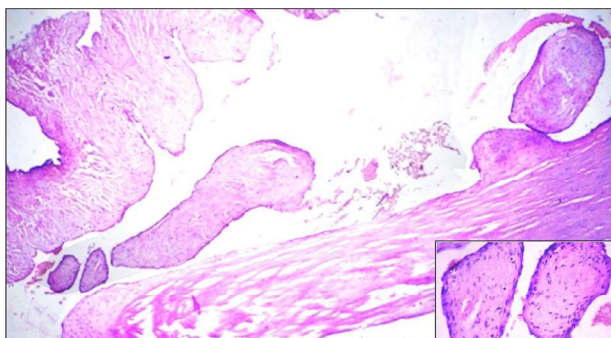


Fig 2: Photomicrograph showing multiple papillary fibroelastomas. Inset- High power view (H and E, x100)

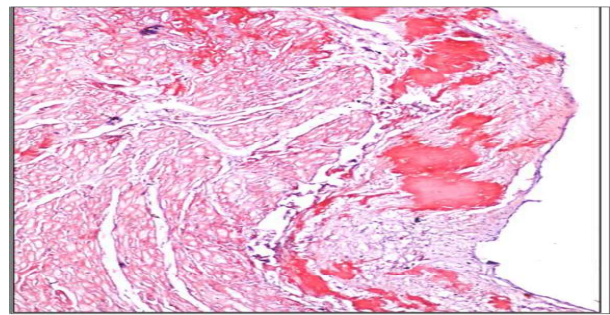


Fig 3: Photomicrograph showing Congo red positive deposits of amyloid in the subendocardium and myocardium. (Congo red, x 40)

We confirmed the deposits to be amyloid by Congo red stain followed by polarizing microscopy which showed the characteristic apple green birefringence.

Conclusion

Autopsy based studies are cost effective for estimating the prevalence of coronary atherosclerosis. In the present study, atherosclerotic coronary artery disease was the most frequently encountered lesion with a strong association between triple vessel disease and ischemic heart disease. Histopathology is crucial in the accurate diagnosis of amyloidosis and rare cardiac tumors like papillary fibroelastoma.

Key message

Every specimen of heart must be thoroughly examined on gross and microscopy.

References

1. Schoen FJ, Mitchell RN. The Heart In: Kumar V, Abbas AK, Fausto N. Robbins and Cotran pathologic basis of diseases. 8th ed. Pennsylvania: Saunders-an imprint of Elsevier; 2010.p.530.
2. Burke A, Tavora F. Practical cardiovascular pathology. 1st ed. Philadelphia: Lippincott Williams and Wilkins; 2011.pp.3-10.
3. Stay HC, Chandler AB, Dinsmore RE, Fuster V, Glagov S, Insull H et al. A definition of advanced types of atherosclerotic lesions and a histological classification of atherosclerosis. A report from the committee on vascular lesions of the Council on Arteriosclerosis, American Heart Association. Circulation 1995;92:1355-74.
4. Marwah N, Sethi B, Gupta S, Duhan A, Singh S, Sen R. Histomorphological Spectrum of Various Cardiac Changes in Sudden Death: An Autopsy Study. Iranian Journal of Pathology 2011;6:179-86.

5. Dhruva GA, Agravat AH, Sanghvi HK, Atherosclerosis of Coronary Arteries as Predisposing Factor in Myocardial Infarction: An Autopsy Study. *Online J Health Allied Scs.* 2012;11:1-4.
 6. Shiladaria P, Chauhan G, Parghi B, Goswami A, Suri S. Coronary Atherosclerosis and Myocardial Infarction : An Autopsy Study. *National Journal of Integrated Research in Medicine* 2013;4:106-8.
 7. Jha BM, Naik D, Agarwal A, Jana S, Patel M. Incidence of Atherosclerosis in different coronary arteries and its relation with myocardial infarction: A randomized study in 300 autopsy hearts in tertiary care hospital. *Int J Med Sci Public Health* 2013;2:836-39.
 8. Garg M, Aggarwal AD, Kataria SP. Coronary Atherosclerosis and myocardial infarction. An Autopsy Study. *J Indian Acad Forensic Med* 2011;33(1)39-42.
 9. Agravat A, Dhruva G, Babaria K, Rathod K. Coronary Artery Disease on Autopsy. A Five Years Clinicopathological Study (November - 2007 to October - 2012). *International Journal of Biomedical and Advance Research*, 4, 105-111.
 10. Travis WT, Brambilla E, Muller-Hermelink HK, Harris CC. Eds. Pathology and genetics of tumours of the lung, pleura and heart. World Health Organisation classification of tumours. Lyon: IARC 2004. pp.313-315.
-