Histopathological study of heart and cardiac vessels in autopsy cases from tertiary health-care center

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ABSTRACT

Background: Atherosclerosis is a chronic inflammatory disease causing more morbidity and mortality in developed as well as in developing countries. Among Indians, atherosclerotic lesions occur 10–15 years earlier, and the lesions are formed in the advanced stage. It is difficult and expensive to evaluate the atherosclerotic lesions in living subjects. Atherosclerosis of cardiac vessels and myocardial infarction are the most common fatal cardiac diseases discovered in autopsies. The incidence of coronary artery diseases is increasing worldwide as well as in India, which carries a huge challenge in diagnosing the same. **Aims and Objectives:** The aims and objectives are to study the spectrum of histopathological findings in heart and atherosclerotic lesions in cardiac vessels in autopsy cases. **Materials and Methods:** This is a retrospective study done in the Department of Pathology at Government Kilpauk Medical College and Hospital over a period of 1 year (March 2022–December 2022). In this study, a total of 100 autopsy cases were taken to study the pathology of the heart and the grading of atherosclerotic lesions in cardiac vessels. Heart specimens were received from the Forensic Medicine Department. The atherosclerotic lesions of cardiac vessels were graded according to the American Heart Association (AHA) classification. **Results:** Among 100 cases studied during a period of 1 year, most of the cases were in the age group of 30–41 years. Male preponderance was noted when compared to females. Out of 100 cases, 79 cases had histopathological evidence of atherosclerosis, and other findings were as follows: one case of giant cell myocarditis, one case of pericarditis, and one case of adenocarcinoma of the lung extending into the coronary vessels. The most common type of atherosclerotic lesion seen was type 7 AHA, most frequently involving the aorta, followed by both coronary ostia and the left anterior descending artery. **Conclusion:** In this study, atherosclerotic lesions were observed very frequently in younger individuals. It is an indication for the implementation of antiatherogenic preventive measures in young populations. It highlights the importance of screening for cardiovascular risk factors at an early age.

Key words: Atherosclerosis; Heart; Cardiac vessels; Autopsy cases

INTRODUCTION

Atherosclerosis is a chronic degenerative condition of the arteries responsible for significant cardiovascular morbidity and mortality worldwide.[1] It is estimated that there are approximately 29.8 million patients with cardiovascular disease in India. An estimated 1.5 million people die of cardiovascular disease every year. The prevalence of coronary heart disease (CHD) in urban areas is 6.5%, and in rural areas, it is 2.5%.[2]

Atherosclerosis can lead to various complications such as myocardial infarction, stroke, embolization, ulceration, thrombosis, and aneurysm, which cause considerable morbidity and mortality, thus affecting the lifespan and quality of life of a large segment of the population.[3] Assessment of atherosclerotic lesions in living subjects is difficult and invasive in nature and can also be an expensive enterprise.[4] Hence, autopsy-based study of coronary vessels and the aorta has been a valuable tool for studying

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these atherosclerotic lesions. It will be a representation of the distribution and prevalence of atherosclerotic lesions present in the population.

Aims and objectives

The aims and objectives are to study the spectrum of histopathological findings in heart and atherosclerotic lesions in cardiac vessels in autopsy cases.

MATERIALS AND METHODS

This is a retrospective study done in the Department of Pathology at Government Kilpauk Medical College and Hospital over a period of 1 year (March 2022–December 2022).

In this study, a total of 100 autopsy cases were taken to study the pathology of the heart and the grading of atherosclerotic lesions in cardiac vessels. Heart specimens were received from the Forensic Medicine Department. Gross findings were noted. Major vessels were carefully examined for any thickening, yellow streaks, frank plaque, or calcification. Following adequate formalin fixation, the tissue specimens were processed, and paraffin sectioning was done, followed by hematoxylin and eosin staining. The findings were documented, and the results were analyzed. The atherosclerotic lesions were graded according to the American Heart Association (AHA) classification.

AHA criteria for grading atherosclerotic lesions.
- Grade 1: Isolated intimal foamy cells (minimal change)
- Grade 2: Numerous intimal foamy cells soften in layers (fatty streaks)
- Grade 3: Pools of extracellular lipid without a well-defined core (intermediate lesion or pre-atheroma)
- Grade 4: Well-defined lipid core with a luminal surface covered by normal intima (atheroma or fibro plaque)
- Grade 5: Lipid core with a fibrous cap with or without calcification (fibro-atheroma)
- Grade 6: Fibro-atheroma with cap defects such as hemorrhage and thrombosis
- Grade 7: Calcification prominent
- Grade 8: Fibrous tissue change is prominent.

RESULTS

Among 100 cases studied during the period of 1 year, most of the cases were in the age group of 31–40 years (29%), as shown in Table 1. Most commonly noted in males (77%) when compared to females (23%), as shown in Table 2. Out of 100 cases, 79 (79%) had histopathological evidence of atherosclerosis, and other findings were as follows: one case of giant cell myocarditis (1%) shown in

Table 1: Age distribution

Age groups (years)	Frequency
0–10	8
11–20	13
21–30	18
31–40	29
41–50	12
51–60	9
61–70	7
More than 70	4
Total	100

Table 2: Gender distribution

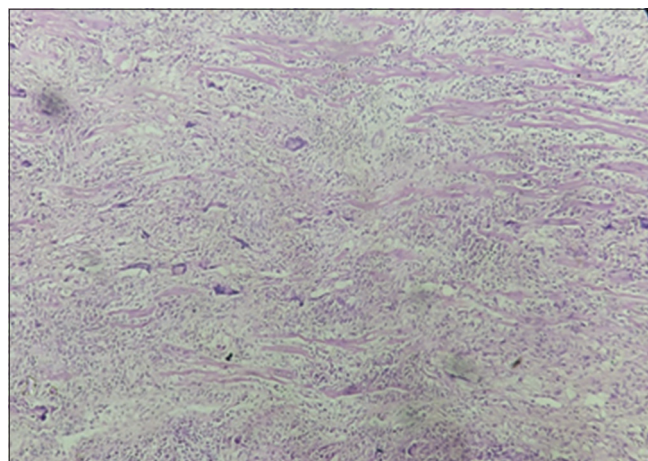| Gender	Frequency
Female	23
Male	77
Total	100

Figure 4, one case of pericarditis (1%), and one case of adenocarcinoma of the lung extending into the coronary vessels (1%). 12 cases show normal histological findings, and 6 cases show autolytic changes. Among the 79 cases of atherosclerosis, 65 (82.27%) were males and 14 (17.72%) were females, as shown in Table 5. Among the 79 cases with atherosclerotic changes, 15 cases show features of left ventricular hypertrophy. The most common type of atherosclerotic lesion noted was type 7 AHA (13.5%), most frequently involving the aorta (66.95%), followed by both coronary ostia (45.55%) and the left anterior descending (LAD) artery (32.91%). The various atherosclerotic lesions encountered in our study were shown in Figures 1-3 (Type 2,4,7 atherosclerotic lesion).

There is a considerable increase in the number of deaths due to coronary atherosclerosis in India, and this number is probably expected to increase in the coming decades if not controlled. The most concerning is the early age of CHD deaths in developing countries as compared to developed countries, which will definitely lame the major workforce of our nation. In the present study, the overall incidence of atherosclerosis was found to be 79%, which is similar to the previous study of Vyas P et al. (73.45%)[2] and higher than what has been found in earlier studies by Dhruva et al.,[3] (23.3%); Golshahi et al., (28.9%);[4] Garg et al., (46.4%);[5] and Yazdi et al., (40%).[6] Percentage of atherosclerosis in comparison with other studies was shown in Table 6. Ischemic heart disease due to coronary vascular disease is mainly caused by atherosclerosis.
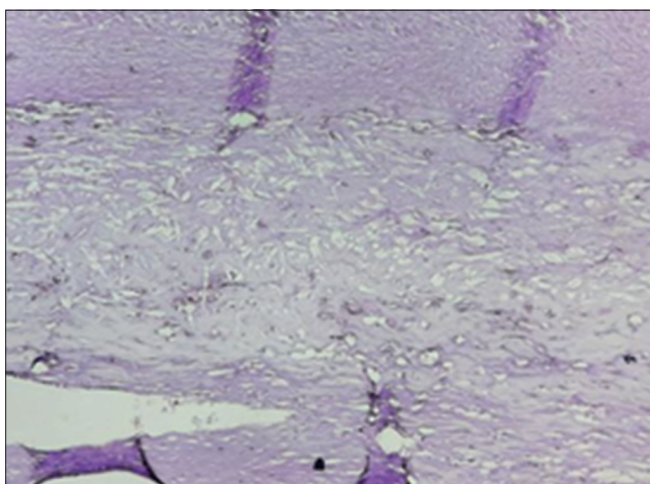
The Indian population is vulnerable to coronary artery disease, and the disease also has an earlier onset of occurrence in our population. In our study, we found that there is a progressive, steady increase in atherosclerosis of coronary vessels in individuals from the third decade of
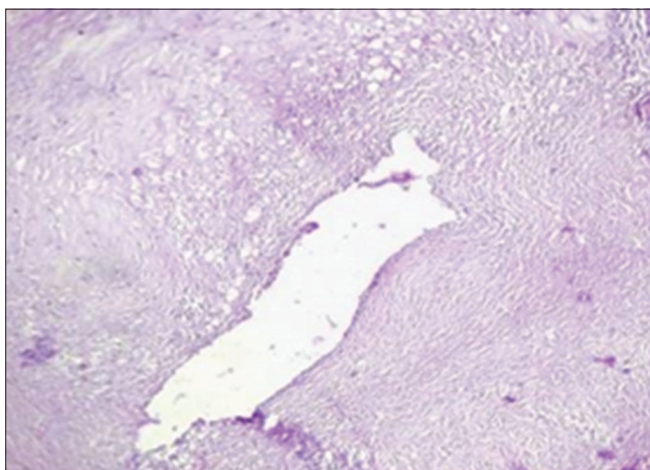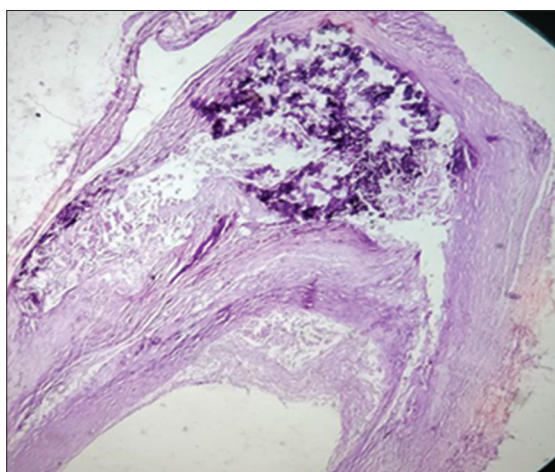
Figure 1: Type 2 atherosclerosis

Figure 2: Type 4 atherosclerosis

Figure 3: Type 7 atherosclerosis

Figure 4: Giant cell myocarditis

Table 3: Age wise gender distribution

Age group (years)	Frequency (male)	Frequency (female)
0–10	5	4
11–20	10	3
21–30	15	3
31–40	19	10
41–50	10	2
51–60	9	0
61–70	6	1
More than 70	3	0
Total	77	23

Tandon et al.,[9] also reported that there was a progressive increase in the number and severity of atherosclerotic lesions from the second and third decades of life onward. Dhruva et al.,[3] also reported similar findings with an increasing frequency of atherosclerosis from the third decade onward and a peak of 76.6% in the 6th decade, followed by a decline to 66.7% in the 8th decade. Garg et al.[5] also noted a progressive increase in atherosclerotic lesions from the third decade onward.

In this modern world, human lifestyle has become complex and challenging. Various life stressors (anxiety, depression, etc.) along with a sedentary lifestyle, lack of exercise, and poor dietary habits such as intake of junk food and increased use of refined and processed food items in place of whole grains and fresh fruits and vegetables can be important factors for the earlier initiation of development and the progressive increase in atherosclerotic lesions in the younger generation. Males show a relative preponderance of coronary artery disease.

In the study conducted by Garg et al., Bhargava and Bhargava,[10] Murthy et al.,[11] and Singh et al., Padmavati et al.,[12] they found coronary atherosclerotic lesions more common in males as compared to females as shown in Table 7. The findings of our study correlate well with the findings of previous studies. There may be a protective role

life onward (21%). Our findings correlate well with those of earlier studies in India. Yazdi et al.,[6] Wig et al.,[8] and Singh et al.,[7] found that significant atherosclerotic lesions start developing in the second decade of life and onward.

Table 4: Distribution of atherosclerotic lesions

Age group years	Aorta	Percentage	Both coronary Ostia	Percentage	RCA	Percentage	LCX	Percentage	LAD	Percentage
0–10	0	0	0	0	0	0	0	0	0	0
11–20	5	6	2	3	1	1	1	1	1	1
21–30	11	14	4	5	6	8	5	6	4	5
31–40	18	23	14	18	7	9	6	8	7	9
41–50	5	6	4	5	6	8	6	8	4	5
51–60	8	10	6	8	4	5	4	5	4	5
61–70	4	5	5	6	2	3	2	3	1	1
>70	2	2	1	1	0	0	1	1	2	3
	53	67	36	46	26	33	25	32	23	30

RCA: Right coronary artery, LCX: Left circumflex artery, LAD: Left anterior descending

Table 5: Age and sex distribution of atherosclerosis

Age (years)	Male	Female	Total
0–10	0	0	0
11–20	14	0	14
21–30	13	1	14
31–40	17	4	21
41–50	11	2	13
61–70	7	7	14
>70	3	0	3
Total	65	14	79

Table 6: Percentage of atherosclerosis in comparison with other studies

Studies	Percentage of atherosclerosis
Present study	79
Vyas P et al.	73.45
Dhruva et al.	23.3
Golshahi et al.	28.9
Garg et al.	46.4
Yazdi et al.	40

Table 7: Gender distribution in comparison with other studies

Studies	Male (%)	Female (%)
Present study	77	23
Garg et al.	80.9	19.1
Bhargava and Bhargava	74.8	24.2
Murthy et al.	82	18
Singh et al.	85	15
Padmavati and Sandhu	66.5	33.5

Table 8: attern of vessel involvement in comparison with other studies

Studies	Single-vessel involvement (%)	Double-vessel involvement (%)	Triple-vessel involvement (%)
Present study	20	26	54
Dhruva et al.	31	17	36
Garg et al.	13	42	44
Yazdi et al.	16	27	30

for female hormones like estrogen against atherosclerosis. Moreover, there is greater indulgence by males in smoking and alcoholism as compared to females, which may possibly explain the male preponderance toward the development of more severe and progressive atherosclerosis.

The average weight of the heart was greater as compared to non-atherosclerotic cases. This may be due to increased cardiac workload and compensatory hypertrophy. As atherosclerosis was found to be more in frequency and degree of severity in males as compared to females, it was also evident that the average heart weight of males was heavier than that of females in the same age group. Our findings are comparable to the similar findings of Vyas P et al.,[2] Dhruva et al.,[3] and Garg et al.,[4] who too found that the average heart weight in males was higher as compared to females.

In the present study, single-vessel involvement was seen in 20%, while two-vessel and three-vessel involvements were seen in 26% and 54% of cases, respectively s shown in Table 8. Three-vessel involvement was the most common in our study. It was correlated with the study given by Dhruva et al., in that a single vessel was involved in 31%, while two and three vessel involvements were seen in 17 and 36% cases, respectively.[3] In their study, Garg et al.[5] reported that triple vessel involvement (44.4%) was the most common, followed by double and single-vessel involvement seen in 42.2 and 13.3% cases, respectively. Yazdi et al., reported that triple vessel involvement (30%) was the most common, followed by double and single-vessel involvement seen in 27% and 16% cases, respectively,[6] but Virmani et al.,[14] showed that single-vessel disease was greater than others (44%).

In the present study, the involvement of the LAD artery, right coronary artery (RCA), and left circumflex artery (LCX) was 33%, 30%, and 32%, respectively. istribution of atherosclerotic lesions was shown in Table 4. This was correlated with the data given by Sudha et al.,[13] who

showed LAD artery as the most common site for plaque (47%), and Yazdi et al.,[6] who showed LAD artery as the most commonly involved artery (60%), followed by RCA (50%) and LCX (42.5%). The findings observed by Dhruva et al., were that the incidence of coronary involvement in LAD artery was 40%, RCA was 32%, and LCX was 30%.

Limitations of the study

Limited sample size in autopsy based studies as well as inadequate clinical history can pose diagnostic problem in some of the cas.

CONCLUSION

According to this study, the incidence of atherosclerosis is more in males, but it is alarming in both sexes. There is a need for screening for cardiovascular risk factors from the early ages of the third decade to prevent some of the unexpected deaths. The best possible way to study the prevalence of atherosclerosis in a population is through autopsy-based studies, as it is very difficult to study this in living people. It also helps in estimating the future burden of atherosclerosis in our population, framing proper health policy, and planning preventive measures to be taken to serve the target population. Similar studies should be carried out on regular time interval with a larger sample size to identify the risk factors.

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