# Prevalence of Coronary Artery Disease: A Tertiary Care Hospital Based Autopsy Study

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## ABSTRACT

**Introduction:** Atherosclerosis and ischemic heart disease (IHD) has become the leading cause of death and disability in India. In developing countries like in India IHD is has a high prevalence in younger population in comparison with the developed countries. The present study highlights the prevalence of atherosclerosis in Jaipur, Rajasthan (INDIA).

**Method:** We studied 122 specimens of the heart received in the department of pathology, SMS Medical College, Jaipur. All cases were examined grossly and microscopically for the presence of atherosclerosis and myocardial infarction. Atherosclerotic lesions were graded according to American Heart Association.

**Results:** Significant atherosclerotic lesions were found in 52.5% cases in coronaries and 13.04% cases in aorta. Left anterior descending artery was most commonly involved (77.5% cases) vessel. Myocardial infarction (M.I.) was seen in 22 cases (27.5%). Chronic M.I. seen in 17 cases (21.25%) and acute M.I. seen in 5 cases (6.25%). Triple vessel involvement was seen in 42.85% cases.

**Conclusion:** The study highlights the high prevalence of atherosclerosis in males as compared to females. The study shows that the incidence of atherosclerosis is increasing in young people. The data obtained by the study may form a baseline for future research.

**KEYWORDS:** Atherosclerosis, Ischemic Heart Disease (IHD), Myocardial Infarction.

## INTRODUCTION

Atherosclerosis is a specific form of arteriosclerosis which is the most frequent and clinically important lesion.[1] Atherosclerosis is an important risk factor for cardiovascular associated morbidity and mortality worldwide. It is a common but complex disease which starts early in childhood.

In western countries cardiovascular disease (CVD) is considered a disease of aged persons, 23% of CVD deaths occur below the age of 70; however in India 52% of CVD deaths occur below the age of 70 years. As a result, there is a tremendous loss of productive working years in India due to CVD deaths. An estimated 9.2 million productive years of life were lost in India in the year 2000, which is expected to reach to 17.9 million years in 2030 (almost ten times the projected loss of productive life in the US).[2]

The prevalence and severity of atherosclerosis and ischemic heart disease among individuals and groups depends on several risk factors some of which are modifiable while others are non-modifiable. Formation of atherosclerotic plaque in blood vessels is a very complex mechanism and includes endothelial dysfunction, lipoprotein accumulation, monocyte adhesion to the endothelium, platelet adhesion, lipid accumulation both intra and extra cellular, its oxidation, smooth muscle cell proliferation and extra cellular matrix deposition.[1]

Recent advances in diagnostic and therapeutic modalities have resulted in increased life expectancy and therefore the quality of life in patients of cardiovascular disease has improved.

To know the prevalence of atherosclerosis at tertiary care centre in Rajasthan a prospective study was conducted on autopsied patients at S.M.S. Medical College, Jaipur, Rajasthan. As autopsy is a place where we get an intact heart specimen alone or as a part of multiple organs sent after medico-legal post mortem so this study provided a platform to study the prevalence, severity and various distribution patterns of atherosclerosis.

## MATERIALS AND METHODS

In the present study, heart specimens from 122 medico-legal autopsied patients were received in the Department Of Pathology, SMS Medical College, Jaipur, Rajasthan, which were examined grossly as well as microscopically for the presence and extent of atherosclerosis in coronaries and ascending part of thoracic aorta for the evidence of myocardial infarction (M.I.). Medical and clinical history was unavailable in some cases.

The heart along with aorta was received and fixed in 10% formalin solution. It was weighed and then examined grossly for the presence of scars of M.I. The heart was opened along the flow of blood which was described by Virchow. After dissection measurements of right ventricular wall, left ventricular wall, inter ventricular septum and stump of aorta were recorded. The three main coronary arteries namely right, left anterior descending and left circumflex and aorta were dissected out. Each coronary artery was sectioned at 3 mm distance with a scalpel. The exposed arteries and aorta were examined for any thickening, yellow streaks, plaque and occlusion by thrombus or calcification. The ventricles were cut transversely at 10 mm interval from the apex to the base. Sections were submitted from the representative areas. After routine processing and paraffin embedding 4 μm sections were taken. All the sections were studied and correlation of gross and microscopic findings was made. The typing of atherosclerotic lesion was done by the American Heart Association.[3]

American Heart Association criteria for grading atherosclerotic lesions
• Grade 1: Isolated intimal foamy cells (minimal change).
• Grade 2: Numerous intimal foamy cells often in layers (fatty streaks)
• Grade 3: Pools of extra cellular lipid without a well-defined core (intermediate lesion or pre-atheroma)
• Grade 4: Well defined lipid core with 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 defect such as hemorrhage and thrombosis
• Grade 7: Calcification prominent
• Grade 8: Fibrous tissue change prominent

## RESULTS

Out of the 122 hearts studied 88 cases (72.13%) were those of males and 34 cases (27.8%) were those of females. Average weight of the heart was 295±31 grams for males and 221±82 grams for females. 80 cases out of 122 cases showed changes of atherosclerosis in coronaries. Aorta was involved in 46 cases out of which males were affected in 35 cases and females in 11 cases. Age wise and sex wise distribution of all cases shown in table no.1.

Atheromas have been seen in very young persons but significant atherosclerotic lesions i.e. grade 4 to grade 8 lesions after 3rd decade of life. There is a gradual increase in frequency and severity from 2nd to 6th decade in life. Significant atherosclerotic lesions were seen in 52.5% cases as shown in table no.2.

**Table 1: Age and Sex distribution of 122 autopsy cases**

| Age group | Males | Females | Total | Percentage |
|---|---|---|---|---|
| <21 | 5 | 5 | 10 | 08.19 |
| 21-30 | 19 | 15 | 34 | 27.86 |
| 31-40 | 28 | 07 | 35 | 28.68 |
| 41-50 | 13 | 04 | 17 | 13.93 |
| 51-60 | 18 | 01 | 19 | 15.57 |
| 61-70 | 03 | 00 | 03 | 02.45 |
| 71-80 | 02 | 02 | 04 | 03.27 |

**Table 2: Distribution of atherosclerosis and M.I. according to age and sex**

| Age groups | Grade 1 | | Grade 2 | | Grade 3 | | Grade 4 | | Grade 5 | | Grade 6 | | Grade 7 | | Grade 8 | | M.I. | | Significant atheroma | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | total | % |
| <21 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 00.0 |
| 21-30 | 1 | 4 | 3 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 2 | 02.5 |
| 31-40 | 2 | 2 | 2 | 1 | 7 | 1 | 2 | 0 | 4 | 0 | 2 | 1 | 2 | 0 | 0 | 0 | 7 | 0 | 11 | 13.75 |
| 41-50 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 3 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 10 | 12.5 |
| 51-60 | 1 | 0 | 3 | 0 | 2 | 0 | 3 | 0 | 2 | 0 | 4 | 1 | 4 | 0 | 0 | 0 | 8 | 1 | 14 | 17.5 |
| 61-70 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 01.25 |
| 71-80 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 4 | 5.00 |
| TOTAL | 7 | 6 | 8 | 2 | 13 | 2 | 7 | 1 | 10 | 2 | 11 | 2 | 7 | 0 | 2 | 0 | 20 | 2 | 42 | 52.5 |

**Table 3: Frequency of the involvement of individual coronary artery and aorta**

| Sr .no | Coronary arteries | No. of cases | Percentage |
|--------|-------------------|--------------|------------|
| 1. | Right coronary artery | 41 | 51.25 |
| 2. | Left main coronary | 56 | 70.0 |
| 3. | Left anterior descending (LAD) | 62 | 77.5 |
| 4. | Left circumflex | 39 | 48.75 |
| 5. | Aorta | 46 | 57.5 |

**Table 4: Distribution of atherosclerotic lesion in aorta according to age and sex**

| Age Group | Grade 1 | | Grade 2 | | Grade 3 | | Grade 4 | | Grade 5 | | Grade 6 | | Grade 7 | | Grade 8 | | Significant atheroma | |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | Total | % |
| <21 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| 21-30 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 02.17 |
| 31-40 | 3 | 3 | 3 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| 41-50 | 3 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| 51-60 | 3 | 0 | 3 | 0 | 3 | 1 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 08.69 |
| 61-70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| 71-80 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 02.17 |
| TOTAL | 14 | 4 | 8 | 2 | 7 | 3 | 2 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 13.04 |
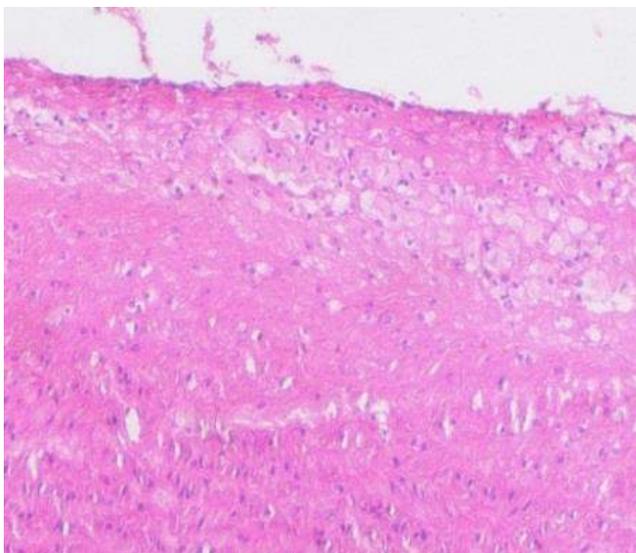


**Fig 1: AHA grade-5 atherosclerotic lesion in aorta H&E stain x100**
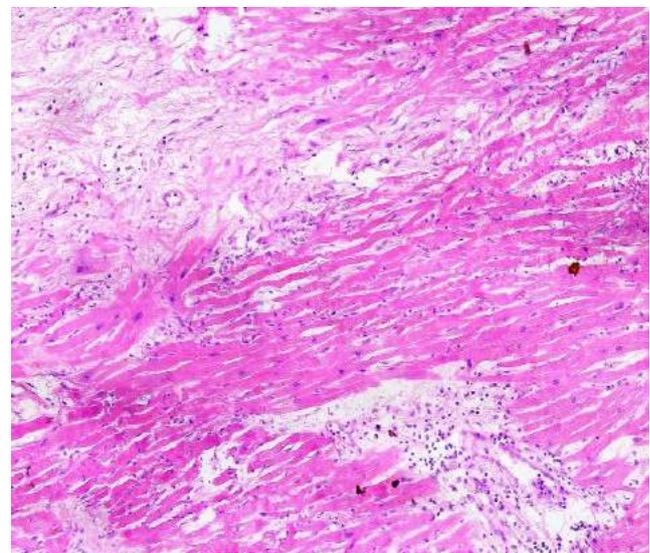


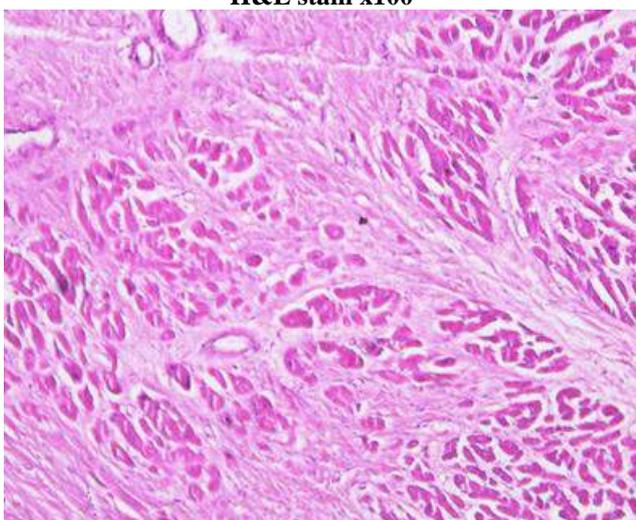**Fig 2: Area of myonecrosis and acute inflammatory infiltrate-Acute M.I. H&E stain x100**



**Fig 3: Areas of fibrosis in myocardium, H&E stain x100**
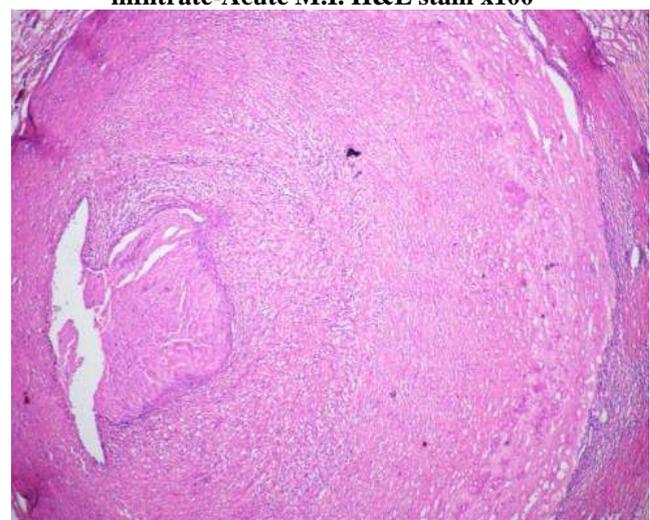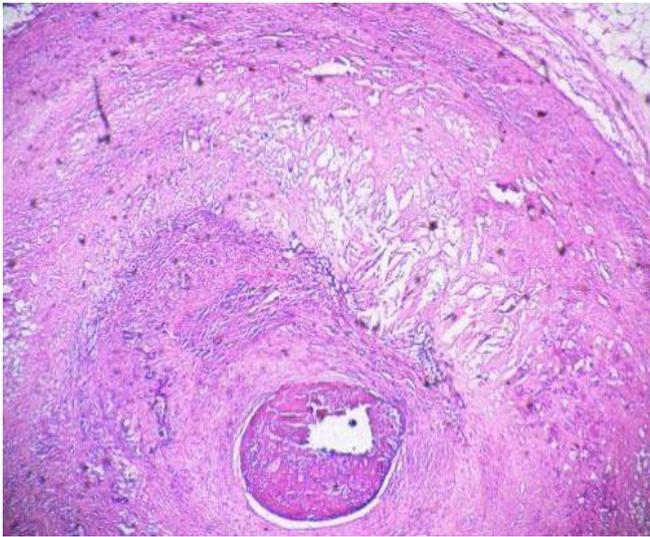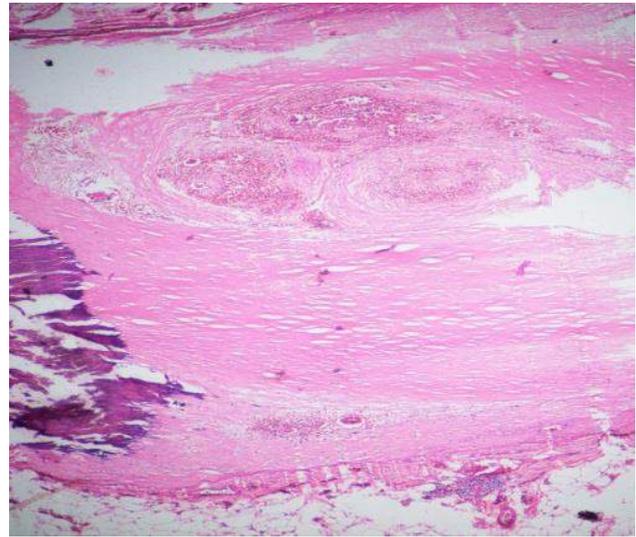


**Fig.4: LAD artery showing occlusion of lumen by thrombus AHA grade-6 H&E stain x40**

**Fig 5: LAD artery showing calcification- AHA grade-7 H&E stain x40**



**Fig-6: LAD artery showing fibrous tissue change - AHA grade-8**

Out of these cases 27.7% cases were showing single vessel involvement, double vessel involvement in 19.48% and triple vessel involvement in 42.85%. The frequency of the involvement of individual coronary artery and aorta shown in table no.3.

Histo-pathological evidence of myocardial infarction was seen in 22 cases (27.5%). Acute M.I. was seen in 5 cases (6.25%) and chronic ischemic heart disease was seen in 17 cases (21.25%). Age range for the patients of M.I. was 22-80 years. Males were affected more commonly than females. 20 cases (90.9%) of M.I were seen in males and 2 cases (9.09%) in females. 86.36% cases of M.I. showed triple vessel involvement. Double vessel involvement was seen in 13.63% cases of M.I. Age and sex wise distribution of atherosclerotic lesion in aorta is shown in table no.4

## DISCUSSION

In the present study 88 cases (72.13%) were males and 34 cases (27.86%) were females which are more or less similar to most of the studies done previously. Shiladaria et al.[4] studied 300 cases which included 216 (72%) males and 84 (28%) females. Garg et al[5] studied 115 cases out of which 93 cases (80.9%) were males and 22 (19.1%) were females. Narsin et al [6] studied 100 cases in which 82 cases (82%) were males and 18 (18%) were females. This is attributable to the fact that males are more commonly involved in smoking and alcoholism for their recreational activities which make them prone to accidents and violence. Atherosclerosis starts early in life and progresses with age to form significant lesion causing coronary artery disease.

In the present study prevalence of atherosclerosis is 65.57 % which is comparable with study done by Garg et al[5] (46.4%) and Singh et al[7] (78%). AHA classified atherosclerosis from grade 1 to grade 8. In the present study most common lesion was pre-atheroma 18.75 %

which is similar to the study done by Shiladeria et al[4] and Garg et al[5].

Significant atherosclerotic lesions i.e. grade 4 to grade 8 were seen in 52.5% cases in 31-60 years of age which is comparable to study done by Udhereja et al[8] (56.30%). Prevalence of atherosclerosis in aorta in present study was (57.5%).

In the present study LAD was most commonly involved vessel in 62 cases (77.5%) followed by left coronary artery 56 cases (70%) and right coronary artery 41 cases (51.25%). Triple vessel involvement was seen in 42.85% cases in our study similar to study done by Garg et al[5] (44.4%). Acute M.I. was seen in 5 cases (6.25%) in the present study, which is comparable with the study done by Udhereja et al[8] (5.2%).

## CONCLUSION

Atherosclerosis is a non-communicable disease showing an unexpectedly high prevalence in Indian population. It is associated with cardiovascular morbidity and mortality. Though males are affected more commonly then females but an alarming rise in prevalence in both sexes needs attention.

This study shows an increase in the number of atherosclerosis and myocardial infarction cases in young population and therefore draws attention for early screening and preventive techniques. The heart is a vital organ and is very difficult to study in living persons so autopsy study provides a good platform for detailed study of atherosclerosis and various lesions. Although the number of cases in present study is small but the observations are correlated with many similar studies done in the past.

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