# **Coronary Atherosclerosis by Modified American Heart Association Classification- An Autopsy Study** Dr Parikh SR<sup>1\*</sup>, Dr Parikh UR<sup>2</sup>, Dr Goswami HM<sup>3</sup>

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### Abstract

**Introduction:** Cardiovascular Disease (CVD) & related mortality has emerged as a major health burden worldwide with atherosclerosis being the major cause. The incidence of coronary artery disease has doubled in Indians during the past three to four decades. Aims & **Objectives:** To study the atherosclerotic lesions in coronary arteries by applying Modified American Heart Association(AHA) classification. **Material & Methods:** This study was conducted in the tertiary care teaching hospital from January to April, 2025 and consists of 131 heart specimens received in Autopsy section. After gross examination respective sections were taken and routine HPE was performed. **Results:** The atherosclerotic lesions were more common in male compared to female with M:F ratio is 3.37:1. Nowadays, the atherosclerotic lesions were more common lesions found in young age group followed by Intimal Thickening was the most common lesions found in older age group. **Conclusion:** Risk factor reduction is the most important to manage young CAD Patients (Males>Females), so as to prevent complications or premature death that lead to huge financial burden on the economy and health sector of India.

**Key words:** Atherosclerotic lesions, Modified American Heart Association classification, Cardiovascular Disease

# Introduction

Cardiovascular Disease (CVD) & related mortality has emerged as a major health burden worldwide with atherosclerosis being the major cause. The incidence of coronary artery disease has doubled in Indians during the past three to four decades.<sup>1</sup> One of the leading cause of ischemic heart disease worldwide and gradually the age of its occurrence have been seen in younger population.<sup>2</sup> Epidemiological data of the last 5 decades indicate a significant increase in the prevalence of coronary artery disease in urban as well as rural India.<sup>2</sup>

Autopsy is a tool of real value for assessment of pathologies, which are difficult to assess in the living. As study of atherosclerosis in the living population is difficult, invasive, and expensive especially in developing countries, autopsy study has been proved to be a good method for assessing atherosclerosis. With the limited amount of resources available in India

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for studying atherosclerosis, autopsy plays a major role. Since atherosclerosis is a giant killer disease, a major financial burden on the nation's economy and health sector, even a modest reduction in its incidence goes a long way in shaping the health of the future generation of the nation.3 Application of the modified American Heart Association classification of atherosclerosis based on morphological descriptions for the assessment of atherosclerosis in the Indian population is of great use. Hence, this autopsy study was undertaken to find out the prevalence of atherosclerosis in the population. As the study of atherosclerosis in the living population is difficult, invasive, and expensive, especially in developing countries, autopsy studies have proved to be a good method for assessing atherosclerosis.

# Aims & Objectives

- To study the atherosclerotic lesions in coronary arteries by applying Modified American Heart Association (AHA) classification.
- Evaluate the atheromatous & vulnerable plaques.
- To find out age and sex wise prevalence of atherosclerosis.

# Material & Methods

This study was conducted in the tertiary care teaching hospital from January to April, 2025 and consists of 131 heart specimens received in autopsy section. Completely autolyzed heart was excluded from this study.

After complete gross examination of outer surface of the heart, it was open by inflow outflow method. Then the specimens were fixed in 10% neutral buffer formalin solution for 24 hours. Measurements of right ventricular wall, left ventricular wall, inter-ventricular septa were taken. Coronary arteries were dissected along the flow of blood. Left Coronary artery (LCA) and Right Coronary Artery (RCA) were dissected longitudinally & each sectioned at 3 mm intervals to examine for any atherosclerotic plaques. The coronaries were examined grossly for the presence of thrombus, narrowing of lumen, plaque of atherosclerosis & calcification.

Tissue bits were taken from LCA and RCA from gross atherosclerotic lesions as well as suspicious lesions for the microscopic assessment of atherosclerosis. If no lesions were found, random tissue bits were taken from above mentioned sites.

After automated tissue processing & Paraffin embedding,  $4-5\mu$  sections were cut using rotary microtome. Haematoxylin and eosin-staining of all the sections were done.

Microscopic grading of atherosclerosis was done using the Modified American Heart Association (AHA) Classification of atherosclerosis.<sup>3</sup>

After microscopic examination the data analysis was carried out using MS Excel 2010.

Table 1: The Modified American Heart Association (AHA) Classification of atherosclerosis

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 cell.	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 les	ions				
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	A thin fibrous cap infiltrated by macrophages and lymphocytes with Rae SMCs and an underlying necrotic core.	Absent,; may contain intraplaque hemorrhage /fibrin			
Plaque rupture	Fibroatheroma with cap disruption; luminal thrombus communication 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 inflammatory cells; a necrotic core may be present	Absent			

#### Results

The present study was conducted between January, 2025 to April, 2025. It includes 131 Heart specimens received in autopsy section in the tertiary care teaching hospital. Out of them 101 were male and 30 were female with M:F ratio is 3.37:1.

Tuble 2 Tige and ber wise Distribution									
Age in	Male	Female	Total	Percentage					
Years				(%)					
21-30	19	12	31	23.66					
31-40	26	4	30	22.90					
41-50	22	10	32	24.43					
51-60	21	2	23	17.56					
>60	13	2	15	11.45					
	101	30	131						

Table 2 Age and Sex wise Distribution

After microscopic examination, various lesions were identified and described according to table 1, Modified American classification for coronary atherosclerosis. The results were tabulated in table 3.

Table 3: Morphological description of coronary artery

Age	Ľ	X	PIT		Fibr	ous	Thin	Thin Cap		Plaque		Calcific		Fibro-	
in					C	ap	Atheroma		Rupture		Nodule		calcific		
Years					Athe	roma							Plaque		
	Μ	F	Μ	F	Μ	F	Μ	F	Μ	F	Μ	F	Μ	F	
21-30	10	6	7	6	1				1						
31-40	6	1	7	3	5		5		1		2				
41-50	1	1	4	6	6	1	9	1			2	1			
51-60	2		3		4		7				5	1		1	
>60			4		2		3		1		1	2	2		
Total	19	8	25	15	18	1	24	1	3	0	10	4	2	1	

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Figure 1: PIT & Fibrous cap atheroma (20X) (H & E Stain)

The table 3 shows that Pathological Intimal Thickening was the most common lesions found in young age group followed by Intimal Xanthoma. While Advanced lesions were found in older age group. Thin Cap Atheroma (TCFA) followed by Pathological Intimal Thickening was common in older age group. Myocardial Infarction, the most common complication of coronary atherosclerosis, was found in 40% cases and was more common in males. TCFA was the most common lesion associated with MI.100% cases with calcific nodules showed changes of MI.



Figure 2: Calcified nodule in a coronary artery and a fibrocalcific plaque with complete occlusion in a coronary artery [10x] (H & E Stain)

# Discussion

As CAD incidence is high in India, & the greater cause for concern is the early age of CAD deaths in the developing countries, this study was carried out to identify the early changes. Young population are being exposed to atherogenic influences like sedentary lifestyle, poor dietary habits, smoking, obesity, family history etc. MI, Aneurysms, Heart failure, Strokes, Sudden death etc are known complications of advanced atherosclerotic plaques markedly increasing mortality and morbidity specially in young age group. Modified AHA classification describes 8 progressive morphological lesions while describing atherosclerosis.CAD is attaining pandemic proportions so the study of subclinical atherosclerosis is the need of the hour to estimate the disease burden in the asymptomatic population. The present study was carried out from January to April, 2025 consists of 131 cases. . Increased amount of atherosclerosis (advanced and intermediate lesions) was found in

the young population during the present study. Advanced lesions were more common in age groups >50 yrs.



Figure 4: Comparison of sex wise incidence of Atherosclerosis<sup>4,5</sup>



Figure 5: Comparison of Atherosclerosis incidence in Younger patients<sup>5,1,6</sup>

The modified AHA classification is based on morphological descriptions compared to the earlier AHA classification, which was not useful in subdividing the intermediate lesions of atherosclerosis. It gives an estimate of the disease advancement and vulnerability of the plaque. The occurrence of erosion and thrombus formation even with intermediate lesions like pathological intimal thickening is noteworthy, as it can lead to thrombus formation followed by sudden cardiac death even in the absence of advanced atherosclerotic lesions. Risk factor reduction is thus of major importance in managing young CAD patients (Males>Females), so as to prevent complications or premature death that lead to huge financial burden on the economy and health sector of India. Defining these intermediate lesions, which have pools of extracellular lipid, is of great importance as they are an indicator of progression to advanced atherosclerotic lesions. Progressive atherosclerotic lesions like thin fibrous cap atheromas (TFCA) carry a higher chance of rupture and thrombosis with consequent obstruction of blood flow in the coronaries, causing IHD.<sup>7</sup> In concordance to present study, most studies reported more prevalence of atherosclerosis in male as compared to female. The higher autopsy rate of males of all age group worldwide contributed to higher frequency of atherosclerosis reported in them but hormonal factors such as estrogen may be responsible for low prevalence of atherosclerotic lesions among young women.<sup>8</sup>

# Conclusion

CAD is attaining pandemic proportions so the study of subclinical atherosclerosis is the need of the hour to estimate the disease burden in the asymptomatic population. Increased amount of atherosclerosis (advanced and intermediate lesions) was found in the young population in this study. Classification by the modified AHA criteria gives an estimate of the disease advancement and vulnerability of the plaque. Risk factor reduction is thus of major importance in managing young CAD Patients (Males>Females), so as to prevent complications or premature death that lead to huge financial burden on the economy and health sector of India.

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