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Spectrum of Aortic and Coronary Atherosclerosis: An Institutional Autopsy Study

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Abstract:

Introduction: Cardiovascular diseases (CVDs) are major causes of mortality in Indian subcontinent. The burden of cardiovascular diseases is increasing rapidly in both rural as well as urban areas. It will soon emergedas largest disease accounting for more than one third of all deaths. Assessment of atherosclerotic lesions in living individuals is very difficult and non-existent due to invasive nature of disease and requirement of advanced set up. Therefore, autopsy-based study of coronary and aortic atherosclerosis is very useful tool to understand epidemiology and prevalence of the disease. *Aims & Objectives:* The main aim of the study is to estimate the prevalence of aortic and coronary atherosclerosis with their severity in tertiary care hospital and correlate it with associated histopathological findings. *Material & Method:* This study was conducted from January 2022 to December 2022 at department of pathology at the tertiary care centre in saurashtra region. Total 178 autopsies were received in a period of one year, out of which 175 autopsies contained heart as specimen. The request form contained previous history and probable cause of death along with specimen details. After the fixation and gross dissection of heart specimen tissue were processed and all the histopathological sections were examined under microscope and categorise for atheroma according to grading by American heart association (AHA). *Results:* Out of 175 patients, 26 (14.9 %) had associated cardiac disease or history of CVD and rest 149 (85.1%) had no any associated cardiac history. The age range was 10 years to 87 years including 61 (34.8%) females and 114(65.2%) males. In total 114 males, coronary atherosclerosis was found to be in 99patients and in 61 female patients, 40 cases of females were having coronary atherosclerosis. Out of 139 cases of atherosclerosis, incidence of involvement of aorta was observed as 58.9% cases in our study with 51.4%, 71.2% and 61.7% involvement of right coronary arteries, left anterior descending arteries and left circumflex arteries, respectively. Incidence of single vessel involvement were in 17 % cases, 28 % cases of double vessel involvement and 55% cases of triple vessel involvement with 12.6% severe atherosclerotic lesions in all three vessels were noted. Eighteen (12.9%) cases showed healed infarct, 11 (7.8%) cases showed acute myocardial infarction in walls of heart and 1 (0.7%)case of myocarditis was seen.*Conclusion:*The study showed high prevalence of atherosclerosis inthe 4th decade of life with male preponderance. Higher incidents of atherosclerosis in younger population gives an indication to take appropriate measures along with life style modification to prevent the cardiovascular diseases such as myocardial infarction and heart failure.

Keywords: Coronary atherosclerosis, Autopsy, Myocardial infarction, Cardiac Pathology.

Introduction:

Cardiovascular diseases(CVDs) are major causes of mortality in Indian subcontinent. The burden of cardiovascular diseases is increasing rapidly in both rural as well as urban areas. It will soon emerged as largest disease accounting for more than one third of all deaths. CVDs such as ischemic heart disease and stroke account for 17.7 million deaths and India accounts for one fifth of the deaths worldwide especially in younger population. At present, India has the highest burden of acute coronary syndrome and ST segment elevation myocardial infarction. [1]Atherosclerosis is the dominant cause of cardiovascular diseases including heart failure, stroke and myocardial infarction(MI). It is mainly located in the intima of medium sized and large arteries. Fatty streaks in arterial wall gradually develop into atheroma and characteristic plaques. Atherosclerotic lesions start developing at younger age and more advanced in Indian population than the western population.[2] Assessment of atherosclerotic lesions in living individuals is very difficult and non-existent due to invasive nature of disease and requirement of advanced set up. Therefore, autopsy-based study of coronary and aortic atherosclerosis is very useful tool to understand epidemiology and prevalence of the disease. It can be true representation of atherosclerotic lesion in individuals with and without any prior history of any

cardiovascular condition.

Material and Methods:

This study was conducted from January 2022 to December 2022 at the department of pathology at a tertiary care center in saurashtra region. The deceased patients who underwent post mortem at forensic medicine department and organs were sent to pathology department for histopathological evaluation. Written informed consent were taken from relatives of patients. Total 178 autopsies were received in a period of one year, out of which 175 autopsies contained heart as specimen. The request form contained previous history and probable cause of death along with specimen details. The hearts were measured, weighedand dissected by modified Virchow's technique and short axis method in case of cardiac causes. The specimens were fixed in 10 percent neutral buffered formalin and after fixation all three coronaries were dissected along with aorta. Sections from all four vessels as well as walls of ventricles and interventricular septum were taken. After routine tissue processing and paraffin embedding, 3-4-micron sections were taken and stained with haematoxylin and eosin (H & E). All the histopathological sections were examined under microscope and categorized for atheroma according to grading by American heart association (AHA).

Grade 0- Normal histology or adaptive thickening without foamy macrophages.Grade 1- Presence of isolated macrophages and foam cells. Grade 2- Mainly intracellular lipid accumulation. Grade 3- Grade 2 lesion along with small extracellular lipid pools.Grade 4- Grade 2 changes with core of extracellular lipid.Grade 5- Lipid core and fibrotic layer or multiple lipid cores and fibrotic lipid layers – mainly calcific or fibroticGrade 6- Surface defect, hematoma, haemorrhages or thrombus formation.The degree of atherosclerosis was classified as unremarkable (Grade 0), Mild (Grade 1-2), Moderate (Grade 3-4) and Severe (Grade 5-6).

Results:

In a period of one year, from January 2022 to December 2022 total 175 hearts were received in the department of pathology. Out of 175 patients, 26 (14.9 %) had associated cardiac disease or history of CVD and rest 149 (85.1%) had no any associated cardiac history. Whereas total thirty six (20.5%) cases showed no evidence of atherosclerosis of aorta or coronary arteries and 139 (79.5%) cases had shown various degree of aortic and coronary atherosclerosis. The age range was 10 years to 87 years including 61 (34.8%) females and 114(65.2%) males. The age and sex distribution of patients are described in Table 1.As described in table 2, In total 114 males, coronary atherosclerosis was found to be in 99 (86.8% of total males) patients and in 61 female patients, 40 cases of females were having coronary and aortic atherosclerosis.

Table 1: Age and sex distribution of autopsy cases

Age (years)	Male (%)	Female (%)	Total (%)
< 20	7 (4%)	3 (1.7%)	10 (5.7%)
21-30	15(8.7%)	10 (5.7%)	25 (14.4%)
31-40	17 (9.7%)	16 (9.2%)	33 (18.9%)
41-50	30 (17.2%)	10(5.7%)	40 (22.9%)
51-60	21(12%)	7 (4%)	28 (16%)
61-70	19 (10.8%)	11 (6.2%)	30(17%)
>71	5 (2.8%)	4 (2.3%)	9 (5.1%)
Total	114(65.2%)	61 (34.8%)	175 (100%)

Table 2: Gender according distribution of atherosclerosis

	With atherosclerosis (%)	Without atherosclerosis (%)	Total (n=175)
Males	99 (56.6%)	15 (8.6%)	114 (65.2%)
Females	40 (22.8%)	21 (12%)	61 (34.8%)
Total	139 (79.4%)	36(20.6%)	175(100%)

Out of total 175 cases, 139 cases had shown various degree of aortic and coronary atherosclerosis. The degree and percentage of atherosclerosis is described in table 3.

Table 3: Distribution of atherosclerosis in aorta and coronary arteries

Grade	Aorta	Right coronary artery	Left anterior descending artery	Left circumflex artery
Normal	72 (41.1%)	85 (48.6%)	50 (28.6%)	67 (38.3%)
Mild	46 (26.3%)	41 (23.4%)	35 (20%)	38 (21.7%)
Moderate	35 (20%)	35 (20%)	66 (37.7%)	53 (30.3%)
Severe	22 (12.6%)	14 (8%)	24 (13.7%)	17 (9.7%)
Total	175 (100%)	175 (100%)	175 (100%)	175 (100%)

As described in above table, the total incidence of involvement of aorta in atherosclerotic lesion were 58.9% cases , incidence of involvement of right coronary artery was 51.4%, for left anterior descending artery 71.2 % being most common artery involved in atherosclerotic

lesion with highest incident of moderate degree atheroma. Left circumflex artery was involved in 61.7% cases.

Table 4: Cardiac Vessel involvements in various atherosclerotic lesions

Vessel involvement	Total cases (%)(n=139)
Single vessel disease	24 (17%)
Double vessel disease	39 (28%)
Triple vessel disease	76 (55%)

Where as in aortic atherosclerosis total 22 (12.6%) cases were of severe calcified atherosclerosis. In 139 total cases with atherosclerosis, 5(3.5%) cases were observed where only aortic atherosclerosis was present without any evidence of coronary atherosclerosis.

Table 5 : Associated histopathological findings

Histopathological findings	No. of cases (%) (n=139)
Healed infarct	18 (12.9%)
Acute myocardial infarction	11 (7.8%)
Myocarditis	1 (0.7%)

Table 6: Comparison of various parameters of atherosclerotic changes with other related studies

Study	Overall incident of atherosclerosis in %	Male preponderance in %	Triple vessel disease in %	Involvement of LAD in %	Associated acute MI findings in %
Vyas P et al[2]	73.4%	82%	22%	40%	10.8%
Dhruva et al[6]	23.3%	73.6%	36%	40%	9.2%
Garg et al[7]	46.6%	80%	44%	31.8%	3%
Yazdi et al [8]	40%	73.1%	20%	60%	-
Singh et al[10]	--	85%	-	49.5%	-
Present study	79.4%	86.8%	55%	71.2%	7.8%

Discussion:

Mortality due to coronary atherosclerosis has emerged as alarming proportions and the number of mortality and morbidity due to atherosclerotic lesions is increasing day by day. Atherosclerotic lesions very pathologically from micro thrombus to macroscopic occlusion of arteries. [3] Now a days, different agents such as age, race, weight, and dyslipidemia are mentioned as risk factors of atherosclerosis.[4] Formation of atherosclerotic lesions starts from early ages, well before its complications. The disease once starts developing can non be reversed back and can made only stagnant. Fatty streaks are present in aorta in most of children more than 3 years and increasing in adolescent with coronary involvement a decade later. [5]The Indian population is more prone to atherosclerotic changes compared to other population, in younger age groups are more prone to show changes of mild to moderate degree of atherosclerosis. In our study, we found rapid increase in incident of coronary atherosclerosis after 3rd decade of life which was similar to other studies such as Yazdi et al [8], Wig et al [9] and Singh et al[10] , where they also found significant development of atherosclerotic lesions from 2nd decade of life and later on. Garg et al [7] also observed increase in atherosclerotic lesions from 3rd decade of life. In aortic lesions, in our study it was noted that the incident of aortic atherosclerosis up to mild degree starts from early 2nddecade of life and progresses further with increasing age, which is corroborative if similar study by K Venkatesh et al [11] , where mild degree atherosclerosis with fatty streaks and intimal thickening stars from 2nd decade and by the 4th decade complicated plaques start to develop. Out of 139 cases of atherosclerosis, incidence of involvement of aorta was observed as 58.9% cases in our study with 51.4%, 71.2% and 61.7% involvement of right coronary arteries, left anterior descending arteries and left circumflex arteries, respectively. The study observed by Sudha et al[13], showed Left anterior descending artery(LADA) being most commonly involved in lesion with plaques with 47% incidence. Study by Vyas P et al[2] also showed 40% of involvement of LADA followed by Right coronary arteries (32%) and Left circumflex arteries(30%). Study by Garg et al [7] showed 38.1%, 35.1% and 34% involvement of LADA, right coronary artery and left circumflex artery respectively.

Limitations:

As this study was done in an institutional level, limited number of specimens were observed. Alsofindings in autopsy cases may or may not mimic the actual changes in living population. Detailed previous history and laboratory profiles were not available for all patients, hence clinicopathological correlation could not be observed.

Conclusion:

The study was conducted with the aim to learn more about incidence and degree of atherosclerosis in cardiac vessels in all autopsy specimen. The study showed high prevalence of atherosclerosis in 4th decade of life with male preponderance. As the cardiovascular diseases have reached pandemic proportions, the study of subclinical atherosclerosis is much needed to Understand and to estimate the burden of the disease. Higher incidents of atherosclerosis in younger population give an indication to take appropriate measures along with life style modification to prevent the cardiovascular diseases such as myocardial infarction and heart failure.

Sources of supports: Nil

Conflicts of Interest: Nil

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