



Original Article:

Atherosclerosis of Coronary Arteries as Predisposing Factor in Myocardial Infarction: An Autopsy Study.

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Abstract: The incidence of coronary heart disease has markedly increased in India over the past few years. Ischemic heart disease, the largest cause of morbidity and mortality in the developed and developing countries today is overwhelmingly contributed by atherosclerosis. The study highlights the impact of atherosclerotic lesions in the population of Rajkot district. We studied atherosclerotic lesions in coronary arteries in cases subjected to autopsy in last 4 years, to grade and to evaluate the atheromatous plaques; and to assess the cases of myocardial infarction amongst them. The study comprises dissected specimens of heart in total 360 cases subjected for autopsy. The vessels were examined for the presence of atherosclerotic lesions which were graded according to American Heart Association and examined for evidence of myocardial infarction. The study comprises the cases in age group between 20 to 80 years. Commonest type of atherosclerosis seen was grade-4. Left Anterior Descending Coronary was most commonly involved artery. Myocardial infarction was the cause of death in 35 cases (9.72%) The data obtained may form a baseline for the forthcoming studies.

Key Words: Atherosclerosis; Coronary; Plaque; Autopsy; Infarction.

Introduction:

Coronary artery disease due to atherosclerosis is an epidemic in India. The incidence of coronary artery disease has doubled during past three to four decades. It will soon emerge as the single largest disease accounting for nearly one-third of all deaths in India. A total of nearly 6.4 crore

cases of coronary vascular disease are likely in the year 2015, nearly 96% would be coronary heart disease cases. Deaths from this group of diseases are likely to amount to be a staggering 34 lakh. An estimated 1.3 million Indians died from this in 2000. The projected death from coronary artery disease by 2015 is 2.95 million, of which 14% will be <30 years, 31% will be <40 years.[1] Major advances in medical, interventional and surgical therapy, together with effective secondary prevention, has resulted in extended life expectancy and an improvement in the quality of life of most patients with clinical coronary artery disease.

Despite these achievements, the prevalence of coronary artery disease seems to remain high. However, the exact data on the prevalence of coronary atherosclerosis or clinical coronary artery diseases are extremely diverse.[2]

In order to assess the magnitude of the problem, a retrospective study of autopsied patients for the presence of atherosclerotic lesions of the coronaries artery and myocardial infarction (MI) was undertaken for four years in the P.D.U. Medical College & Hospital, Rajkot. An autopsy study gives a good measure of the prevalence, grading and distribution pattern of atherosclerotic lesions.

Material and Methods:

In the present study, heart specimens of 360 post-mortem cases, received in the forensic pathology section of the P.D.U. Medical College & Hospital, Rajkot were examined

grossly and microscopically for the presence and extent of atherosclerosis and evidence of MI.

The medical history & clinical diagnosis before death were, in few of the cases, unavailable. Few specimens underwent autolysis before examination.

The heart were fixed in 10% formalin, weighed and then investigated for the presence of scars of MI. Measurements of right ventricular wall, left ventricular wall, inter-ventricular septa and stump of aorta were taken. Circumferences of mitral, tricuspid, pulmonary and aortic valve were noted. The three main coronary arteries were dissected out. Each coronary artery was then sectioned by multiple closely spaced cuts with a scalpel. The exposed artery was carefully examined for any thickening, yellow streaks, frank plaque or calcification. Then ventricles were sectioned transversely at 10 mm intervals commencing from apex.

After routine processing & paraffin embedding 4 micro-meter sections were taken. All the histological sections were examined microscopically for the presence of atheroma, ischemic heart disease, & MI. American Heart Association typing of atherosclerotic plaque was done. Special stains were performed according to need & nature of lesion.

American Heart Association criteria for grading atherosclerotic lesions [3, 4]

- 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 haemorrhage and thrombosis
- Grade 7 - calcification prominent
- Grade 8 - fibrous tissue change prominent

Results:

Of the 360 heart studied, 73.6% were males & 26.4% were females. The weight of the heart was determined to be 270 ± 75 grams for males and 248 ± 85 grams for females. Out of these 25 specimens were autolysed. All the cases were divided into the age group according to the age at death as per Table-1.

Table-1: Sex and age distribution of 360 autopsied cases				
Age group	Males	Females	Total	%
<21	20	7	27	7.5
21-30	61	29	90	25
31-40	81	31	112	31.1
41-50	57	12	69	19.2
51-60	23	07	30	8.3
61-70	18	08	26	7.2
>70	5	01	06	1.7
Total	295	95	360	

The degree of atherosclerosis encountered in different age groups is shown in Table-2. Atheroma have been seen above the age of 20 years, but significant atheroma appeared after third decade onwards and thereafter there is a gradual increase in both its frequency and severity from second to sixth decade. Maximum incidence was in the sixth decade of life. Commonest type of atherosclerosis was grade 4. Amongst the atherosclerotic coronaries, on an average

14.28% showed calcification and 69.04% of the cases showed significant atheroma i.e. grade 4 to grade 7. Out of total 84 atherosclerosis cases 31 had single vessel involvement whereas two vessels and three vessels were involved in 17 and 36 cases respectively. The incidence of atherosclerotic plaque and number of artery involved become higher as the age increases.

Table-2: Degree of atheromas correlated with age										
Age	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Total	Total Atheroma	%
<21	0	0	0	0	0	0	0	27	0	0
21-30	1	1	3	1	1	1	0	90	8	8.9
31-40	0	1	5	7	2	2	1	112	18	16
41-50	1	0	6	8	3	1	2	69	21	30.4
51-60	0	1	4	3	3	7	5	30	23	76.5
61-70	1	0	1	2	1	2	3	26	10	38.5
>70	0	0	1	2	0	0	1	06	4	66.7
Total	3	3	20	23	10	13	12	360	84	

Of 58 cases with significant atheroma, Left Anterior Descending was most commonly involved Coronary Artery.

35 cases of MI had one or more coronaries showing atherosclerosis.

Evidence of myocardial infarction at autopsy was found in 35(9.72%) cases; the age of MI patients ranged between 32 and 80 years with an average of 55 ± 15 years. 31 cases out of

Discussion:

There is an alarming increase in the number of deaths due to coronary atherosclerosis in India and this number is expected

to escalate rapidly in the next decade. Atherosclerosis is a common phenomenon which is seen with different prevalence in different races. It begins in childhood and progresses through young adulthood to form the lesions that causes coronary heart disease.

In the present study it was observed that 265 cases (73.6%) were males and 95 (26.4%) were females which are more or less similar to most of the studies done in past. Bhargava et al [5] studied 74.8% males and 24.2% females in their study. Murthy et al [6] studied 150 cases out of which 123 (82%) were males and 27(18%) were females. Singh et al [7] studied 200 cases with 17(85%) males and 30(15%) females. Padmavati [8] and Tandon [9] found 66.5% males and 33.5% females. The reason being that as males are bread earners and females usually doing house hold works, which Makes the males more vulnerable to accidents, violence and stress. Also males more indulge themselves in smoking alcoholism etc.

Mean heart weight in our study was 270 ± 75 grams for males and 248 ± 85 grams for females, which was comparable to Monika Garg et al [10] found 289 ± 71 grams for males and 269 ± 77 grams for females. American Heart Association characterized & classified atherosclerotic lesions from type 1 to type 7. It was proposed that these lesions progressed from one type to the next. Now plaque rupture is established to be the most significant determinant of thrombus mediated acute coronary syndrome.

The atheroma type was the most common type in our study (27.4%).next in frequency was preatheroma (23.8%).However Sudha et al [11], Virmani et al [12] & Sary et al [13] found ruptured plaque as most common type with the frequency 11%, 37.5% & 33%, but in cases of coronary heart disease most frequent lesion was grade-4 fibroplaque formation (38%) followed by grade-6 (26%). These findings are correlating to those reported by Virmani et al (37.5%) [12] & Farb et al (33%).[14]

Atherosclerotic lesions develop very early in life starting from age 15 years onwards. Overall incidence of atherosclerosis was found to be 23.3% which was comparable with the frequency given by Golshahi et al (28.9%) [15] and Yazdi et al (40%).[16] The degree of atheroma encountered in different age group and in two sexes. Significant atheroma appeared in third decade onwards and thereafter there is a gradual increase both in its severity and frequency from third decade onwards. Maximum incidence was in sixth decade

(76.6%) and there was a decline to 66.7% in eight decade. Earlier studies in India by Wig [17] found significant atheroma in two-third of cases above the age of 20 years while Tandon [9] found atherosclerosis in second and third decade. Singh et al [7] found atherosclerosis at the age of 17 years. Thereafter, there was steep rise in all the studies. Syed et al observed that after the second decade atherosclerosis suddenly increases and under 20 years rarely advanced plaques were existed. Although we cannot explain the reason for sudden increase after the third decade but it deserves to attract enough attention.

Incidence of coronary involvement in Left Anterior Descending Artery was 40%, Right Coronary Artery 32% & Left Circumflex Artery 30%. This was in concordance with the data given by Sudha et al [11] who showed Left Anterior Descending as the most common site for plaque (47%) and

Yazdi et al [16] who showed Left Anterior Descending as the most commonly involved artery (60%), followed by Right Coronary Artery (50%) and Left Circumflex Artery (42.5%).

Single vessel involvement was seen in 31% while two vessels and three vessel involvements was seen in 17% and 36% cases (Fig.1). Three vessels involvement was the most common in our study. It was correlated with the study given by Yazdi et al [16] but Virmani et al [12] showed single vessel disease was greater than others (44%).

Acute MI was seen in 35 cases (9.72%) comparable with the data given by Maru (6.5%).[18] The contribution of hypertension, serum cholesterol and cigarette smoking could not be assessed.

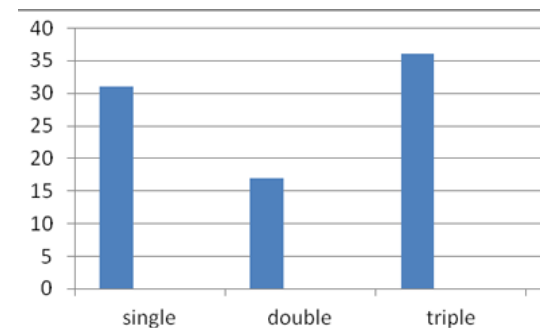


Figure 1: Involvement of coronary vessels in Atheroma.

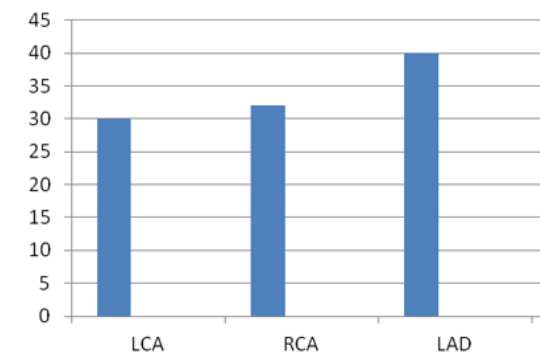


Figure 2: Involvement of 3 major arteries in MI

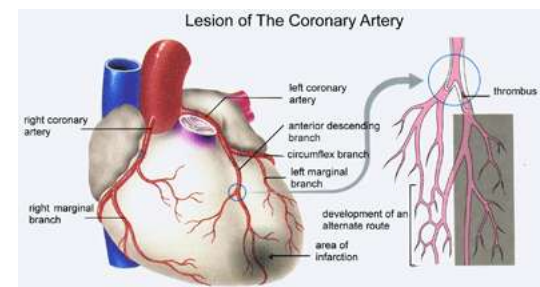


Figure 3: Various coronary arteries.

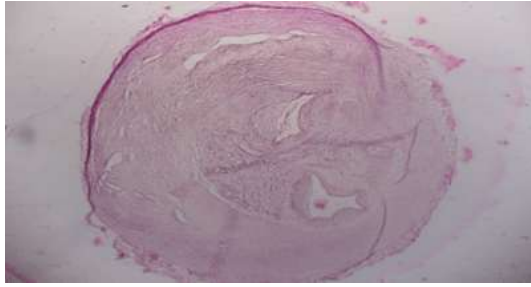


Fig 4 Severe atherosclerosis with calcification

Conclusion:

The study showed unexpectedly high prevalence of atherosclerosis in Rajkot, India. Though the incidence of atherosclerosis is more common in males compared to females, but in both sexes it is an alarming post mortem finding. This study highlights the importance of atherosclerosis as an cardiovascular risk factor which needs to be screened from young age group. Our study aids valuable data to the literature regarding the morphology of atherosclerotic lesions. The study of human atherosclerotic lesion is an extremely difficult task in a living subject and autopsy study is the best possible way to work on it. Though our study involved only a small number of cases, most of our observation correlated with the many similar studies.

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