Coronary Atherosclerosis and Myocardial Infarction: A Hospital Based Retrospective Study

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\textbf{ABSTRACT}

\textbf{BACKGROUND:} The incidence of coronary heart disease has markedly increased in the past few years. It is known that myocardial infarction and atherosclerosis causes high mortality and morbidity in the developed countries. Its incidence is also rising in developing countries. \textbf{MATERIAL AND METHOD:} Total 416 specimen received in autopsy section analyzed retrospectively. All specimens were examined grossly and microscopically for the presence and extent of atherosclerosis and evidence of Myocardial Infarction (MI). \textbf{RESULTS:} The study comprises dissected specimens of heart in 416 cases subjected to autopsy. Incidence of atherosclerosis was 55.76\% cases. Commonest type of atherosclerosis seen was grade-IV. Triple vessel involvement was seen in 51.94\% cases. Left Anterior Descending was most commonly involved artery. Evidence of acute myocardial infarction at autopsy was found in 33(8.41\%) cases while the scars of healed MI and Chronic ischemic changes were found in 63(16.1\%) cases. Incidence of myocardial infarction was higher in males in compare to females. Elderly women were more subjected to develop myocardial infarction. \textbf{CONCLUSION:} The study unexpectedly high prevalence of atherosclerosis which was an alarming post mortem finding. This study highlights the importance of atherosclerosis as risk factor of myocardial infarction in developing country like us.

\textbf{Key Words:} Atherosclerosis, Myocardial Infarction, Young Age, Sudden Death.

\textbf{INTRODUCTION}

Atherosclerosis is characterized by intimal lesions called atheromas, or atheromatous or fibrofatty plaques, which protrude into and obstruct vascular lumens and weaken the underlying media. Coronary atherosclerosis represents the leading cause of death in adults in the western countries as well as 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.\textsuperscript{1} Myocardial infarction (MI) is the lethal manifestation of coronary atherosclerosis and can present as sudden death.\textsuperscript{2} This could be first manifestation of coronary heart diseases.

Coronary atherosclerosis is the most common findings of autopsies of sudden cardiac death.\textsuperscript{3} 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.\textsuperscript{4} Majority of cases of coronary atherosclerosis are due to risk factors that include hypertension, smoking, Diabetes Mellitus (DM), and elevated serum cholesterol levels.\textsuperscript{5} Multiple mechanisms contribute to plaque formation and progression including endothelial dysfunction, monocyte adhesion, infiltration, lipid accumulation and oxidation, smooth muscle proliferation, extracellular matrix deposition and thrombosis.\textsuperscript{6}

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In order to know the magnitude of the problem, a retrospective study of autopsied patients for the presence of atherosclerotic lesions of the coronary arteries and myocardial infarction (MI) was undertaken for the period of one year from January 2013 to December 2013 at a tertiary care hospital affiliated with Medical College.

**MATERIALS AND METHODS**

Present study was conducted retrospectively at a Tertiary Care Hospital affiliated with Medical College. Total 416 Postmortem cases were included in the study after exclusion of autolysed specimens. All specimens were examined grossly and microscopically for the presence and extent of atherosclerosis and evidence of MI. After receipt of specimen they were fixed in 10% formalin, weighed and then investigated for the presence of scars of MI. Measurements of right ventricular wall, left ventricular wall, interventricular septum were taken. Circumferences of mitral, tricuspid, pulmonary and aortic valve were noted. The three main coronary arteries were dissected out. 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 to 6 micron sections were taken. All the histological sections taken from all walls of heart and the three coronary branches were examined microscopically for the presence of atheroma, ischemic heart disease, & MI. American Heart Association typing of atherosclerotic plaque was done. American Heart Association criteria for grading atherosclerotic lesions:

- **Grade I** - Isolated intimal foamy cells (minimal change)
- **Grade II** - Numerous intimal foamy cells often in layers (fatty streaks)
- **Grade III** - Pools of extra cellular lipid without a well defined core (intermediate lesion or pre-atheroma)
- **Grade IV** - Well defined lipid core with luminal surface covered by normal intima (atheroma or fibro plaque)
- **Grade V** - Lipid core with a fibrous cap with or without calcification (fibro-atheroma)
- **Grade VI** - Fibro-atheroma with cap defect such as hemorrhage and thrombosis
- **Grade VII** - Calcification prominent
- **Grade VIII** - Fibrous tissue change prominent

In present study, atherosclerosis with more than grade II were considered for analysis as they are known to have pathogenic effect. Analysis of results were carried out in excel spread sheet 2007.

**RESULTS**

Total 416 heart specimens were included from which, 85.33% were from males and 14.67% were from females. All the cases were divided into the age group according to the age at death as per Table-1. Most common age group was found 31-40 years which comprised of 23.79% cases.

The degree of atherosclerosis encountered in different coronaries is shown in Table-2. In Left Anterior Descending (LAD), Left Circumflex (LCX) and Right Coronary Artery (RCA) type IV atherosclerosis was most prevalent finding found in 73, 75 and 89 cases respectively.

**Table 1: age and sex wise distribution**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Age Group</th>
<th>Total Cases</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>≤ 20</td>
<td>29 (6.97%)</td>
<td>23</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>21-30</td>
<td>85 (20.43%)</td>
<td>69</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>31-40</td>
<td>99 (23.79%)</td>
<td>89</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>41-50</td>
<td>97 (23.31%)</td>
<td>84</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>51-60</td>
<td>68 (16.34%)</td>
<td>62</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>61-70</td>
<td>24 (5.76%)</td>
<td>17</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>≥ 71</td>
<td>14 (3.86%)</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>416 (100%)</td>
<td>355</td>
<td>61</td>
</tr>
</tbody>
</table>

Out of total 416 cases 232 (55.76%) showed changes of atherosclerosis. Out 232 cases of atherosclerosis cases 22 had single vessel involvement whereas two vessels and three vessels were involved in 36 and 174 cases respectively. Evidence of acute myocardial
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Infarction at autopsy was found in 35 (8.41%) cases while the scars of healed MI (HMI) and Chronic ischemic changes (CIC) were found in 67 (16.1%) cases. The age of MI patients ranged between 23 and 85 years with an average of 52.98±12.40 years.

Table 2: Degree of atherosclerosis in coronary arteries.

<table>
<thead>
<tr>
<th>Grade of Atherosclerosis</th>
<th>LAD</th>
<th>LCX</th>
<th>RCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>73</td>
<td>61</td>
<td>77</td>
</tr>
<tr>
<td>IV</td>
<td>73</td>
<td>75</td>
<td>89</td>
</tr>
<tr>
<td>V</td>
<td>21</td>
<td>18</td>
<td>11</td>
</tr>
<tr>
<td>VI</td>
<td>12</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>VII</td>
<td>61</td>
<td>53</td>
<td>44</td>
</tr>
<tr>
<td>VIII</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 3: Predominant type of atherosclerosis in myocardial infarction

<table>
<thead>
<tr>
<th>Grade</th>
<th>AMI</th>
<th>HMI/CIC</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>IV</td>
<td>11</td>
<td>23</td>
<td>34</td>
</tr>
<tr>
<td>V</td>
<td>3</td>
<td>4</td>
<td>7</td>
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<td>VI</td>
<td>3</td>
<td>2</td>
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<td>VII</td>
<td>15</td>
<td>33</td>
<td>48</td>
</tr>
<tr>
<td>VIII</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>67</td>
<td>102</td>
</tr>
</tbody>
</table>

Predominant type of atherosclerosis found in all MI cases was shown in table no.3. Type VII atherosclerosis was most commonly found predominant lesion (48 cases) in acute and healed MI followed by type IV atherosclerosis (34 cases).

DISCUSSIONS

There is a significant increase in the number of deaths due to coronary atherosclerosis in India and this number is expected to increase 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 335 cases (85.03%) were males and 59 (14.97%) were females which are more or less similar to most of the studies done in past. Shiladaria et al studied 115 cases out of which 93 cases (80.9%) were males and 22 (19.1%) were females. Dhruba GA et al studied 360 cases out of which 265 cases (73.6%) were males and 95 (26.4%) were females. Murthy et al studied 150 cases out of which 123 (82%) were males and 27(18%) were females. Singh et al studied 200 cases with 170 (85%) males and 30 (15%) females. Padmavati and Tandon found 66.5% males and 33.5% females.

The reason being that as males are bread earners and females usually doing household work, which makes the males more vulnerable to accidents, violence and stress. Also males more indulge themselves in smoking; alcoholism etc.

Atherosclerotic lesions develop very early in life starting from age 15 years onwards. Overall incidence of atherosclerosis was found to be 54.06% which was higher than studies by Golshahi et al (28.9%) and Yazdi et al (40%). The degree of atheroma encountered in different age group and in both 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.

Incidence of coronary involvement in Left Anterior Descending Artery was 58.17%, Right Coronary Artery 55.28% & Left Circumflex Artery 53.12%. This was in concordance with the data given by Sudha et al, Dhruba et al who showed Left Anterior Descending as the most common site for plaque (47%, 40%) and Yazdi et al 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 8.45% while two vessels and three vessel involvements was seen in 14.55% and 76.99% cases. Three vessels involvement was the most common in our study. It was
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correlated with the study given by Yazdi et al but Virmani et al showed single vessel disease was greater than others (44%).\textsuperscript{15,17} Acute MI was seen in 33 cases (8.97%) comparable with the data given by Maru (6.5%).\textsuperscript{18}

It is now recognized that the preexisting culprit lesion in patients who develop myocardial infarction and other acute coronary syndromes is not necessarily a severely stenotic and hemodynamically significant lesion prior to its acute change. Pathologic and clinical studies show that plaques that undergo abrupt disruption leading to coronary occlusion often are those that previously produced only mild to moderate luminal stenosis. Most often, the initiating event is disruption of previously only partially stenosing plaques may be 1) Rupture/fissuring, exposing the highly thrombogenic plaque constituents. 2) Erosion/ulceration, exposing the thrombogenic subendothelial basement membrane to blood. 3) Hemorrhage into the atheroma, expanding its volume.\textsuperscript{5}

Evidence of acute myocardial infarction at autopsy was found in 35(8.97%) cases while the scars of healed MI and Chronic ischemic changes were found in 67(15.98%) cases. Similar findings were observed in study by Shiladaria with 22.46% cases of MI and Dhruba GA with Garg M 3% cases of acute MI while 26.8% cases of HMI. Maru et al showed 6.5% cases of acute MI.\textsuperscript{1,8,9,18}

Throughout life, men are at significantly higher risk of MI than women; this difference progressively declines with advancing age, Except for those having some predisposing atherogenic condition. Women are remarkably protected against MI during the reproductive years due to protective effect of estrogen.\textsuperscript{6} Our findings showed that out of 102 cases of MI females comprised for only 11 cases. Out of 11 cases 8 females were of more than 45 years of age. These rise is may be due to decrease of estrogen following menopause. Which can permit rapid development of coronary artery disease and Ischemic Heart Disease is the overwhelming cause of death in elderly women.\textsuperscript{6}

CONCLUSION

The study showed unexpectedly high prevalence of atherosclerosis and Myocardial infarction. Though the incidence of atherosclerosis and myocardial infarction is more common in males compared to females, but in both sexes it is an alarming post mortem finding. Increased incidence of MI was found in elderly women. This study highlights the importance of atherosclerosis as a cardiovascular risk factor which needs to be screened from young age group. 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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