Atherosclerosis of Coronary Arteries - An Autopsy Study

By Prabhu.M.H, Siraj Ahmed S & Aftab Begum

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Methods : Heart specimens were obtained from medicolegal autopsies. Sections from representative areas were studied for gross and microscopic evidence of atherosclerosis.

Results : Among the 50 cases studied 35 were males and 15 were females. Coronary arteries of 24 males (72.72%) and 9 females (27.27%) showed atherosclerosis. Males were affected more than females. Age has a dominant influence on atherosclerosis, it increased with age. 33 (66%) cases showed coronary atherosclerosis. Upper class, obesity, alcohol consumption and cigarette smoking trends have dominant role in acceleration of atherosclerotic lesions. Religion and vegetarianism have lesser affect on atherosclerosis. Among coronaries, left anterior descending artery is most commonly involved.

Keywords : autopsy, atherosclerosis, coronary arteries.

GJMR-I Classification : NLMC Code: WG 410

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Conclusion: Autopsy studies play a vital role in unraveling the spectrum and occurrence of atherosclerosis. Atherosclerosis is a complex and multifactorial disease. Smoking and alcoholism can accelerate the development of atherosclerosis. The incidence of atherosclerosis in developing countries (like India) is same as developed countries.

Keywords: autopsy, atherosclerosis, coronary arteries.

I. Introduction

The disease atherosclerosis has great relevance today. Atherosclerosis is a distinctive form of arteriosclerosis known from ancient times. The terms ‘athere’ (meaning-porridge) and sclerotic (hardening or fibrosis) derived from Greek terminology, do not represent the complete morphology of disease. Despite our familiarity with this disease, some of its fundamental characteristics remain poorly recognized and understood. The cause and pathogenesis of atherosclerosis remain subject of lively speculation and controversy.

Atherosclerosis is a pathological entity and a multifactorial disease of large and medium sized arteries, characterized by plaque like intimal deposits which contain neutral fats, cholesterol, lipophages, blood elements, at times, other evidence of hemorrhage and calcium deposits. Complications of which are disastrous – ischaemic heart disease, cerebral stroke, peripheral gangrene and so on. It is a pandemic, percentage incidence of morbidity varies from country to country. It is a modern epidemic in U.S.A., Europe, Canada, New Zealand and Australia.

Among the diseases in the western world, atherosclerosis is overwhelmingly the prime disorder leading to death and serious morbidity. Despite recent reduction in mortality of coronary heart diseases (CHD) about 50% of all deaths in US are still attributable to atherosclerosis related diseases. The developing countries such as India, Singapore, Malaysia and Sri Lanka are catching up and registering a steady increase in the mortality rates due to atherosclerotic heart diseases. In India coronary heart disease accounts for 10-15% of all cardiovascular diseases.

The exact global incidence of atherosclerosis is impossible to calculate because it can exist without producing any symptoms or signs. These asymptomatic cases can be diagnosed only if an autopsy is done, in all cases of death due to any cause. However, the magnitude of the problem can be assessed by looking at the mortality rates in different countries due to atherosclerotic heart disease. In a survey conducted in males in the 45 to 54 years age group, the mortality rates due to atherosclerotic heart disease in different countries are lowest in Japan (8%) and highest in Finland (41%). In U.K., U.S.A., and Canada the average mortality rate is 36%. The disease is increasing in countries undergoing industrialization.

Unfortunately, in India there are no statistics giving the national incidence of this disorder. However, Padmavathi and associates gave the average incidence of atherosclerotic heart disease in seven different states during 1958–59 as 0.51% per 1,000 population. In another study conducted at All India Institute of Medical sciences, New Delhi, with the help of autopsy studies and taking atherogenic index as an
indicator, the incidence of coronary heart disease is
given as 35.5% in males and in females as 14%.5
Although global incidence, a wide range of
variation in the prevalence and severity of
atherosclerosis has been shown to exist in different
geographic population. Against this background the
present study has been taken in order to determine the
severity and distribution of coronary atherosclerosis in
the selected autopsies of the deaths occurring in
general population Karnataka state, which has good
representation of all social classes.

II. Methodology

a) Materials And Methods

The material for the present study included 50
(fifty) heart specimens obtained from medico legal
autopsies performed in the Department of Forensic
Medicine, Basaveshwara Medical College and Hospital,
Chitradurga and other heart specimens received at the
Department of Pathology, Basaveshwara Medical
College and Hospital, Chitradurga, sent for
histopathological examination to define any suspected
cardiovascular pathology. Hearts were obtained by
standard procedures from all autopsies.

The age, sex and relevant information including
age, sex, socio-economic status, dietary habits of the
deceased were obtained from the informant
accompanying the deceased.

The methods used for the analysis of the
material was as per the procedure recommended by
1. White, Edward and Dry (1950).8
2. Gore and Tejada (1957).9
3. W.H.O. study group (Technical report series, 1958,

All autopsies were carried out within four to
twenty four hours after death.

All the specimens of right and left coronary
arteries blocks were taken at a particular fixed distance
at from 1.5 cm and 3 cm from the Ostia, also From the
circumflex branch of the left coronary artery, bits were
taken at the same distance form the point of branching
of the left coronary artery into anterior descending and
circumflex branches. Additional bits of tissue were taken
from other regions of the vessels which showed
stenosis. This stenosis is graded based on the luminal
narrowing of the coronaries when examined by hand
lens and is graded from grade 0 (no narrowing / normal)
to grade IV (complete obliteration).

Grade – 0         :      Normal
Grade – I           :      1-25% stenosis
Grade – II          :       26-50% stenosis
Grade – II          :       51-75% stenosis
Grade – IV        :       76-100% stenosis

The bits of the tissue were fixed in 10% formalin
and embedded in paraffin. Sections for histological
study were taken from the paraffin blocks and stained
with haematoxylin and eosin. Special stains were also
done whenever indicated, namely Verhoeff and Van-
Gieson’s for demonstration of elastic tissues, smooth
muscle and collagen, and Alcain blue for the
demonstration of mucopolysaccharide ground
substance. All histological sections were studied for
microscopic evidence of atherosclerotic lesions.

III. Results

The coronary arteries of fifty specimens of heart
were examined in the department of Pathology, Basaveshwara Medical College and Hospital,
Chitradurga, observations made from the study are as
follows:

The youngest subject was 19 years and the
oldest was a male of 80 year age, forming a age range
of 19-80 years. The majority of the cases were from 3rd
to 4th decades of life forming 58% of total number of
cases studied. There were 35 males and 15 females in
the ratio of 2.5:1. Among the fifty cases studied 33
cases showed evidence of coronary atherosclerosis.

All alcoholics were greater in
incidence of atherosclerosis (78.26%) than in non-alcoholics (55.55%).
Graph 2: Alcoholism and atherosclerosis

Table 3: Coronary Atherosclerosis

<table>
<thead>
<tr>
<th>Age group</th>
<th>Sex</th>
<th>Total No. of cases</th>
<th>No. of positive cases</th>
<th>Total positive</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-20</td>
<td>Male</td>
<td>2</td>
<td>2</td>
<td>2/4</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>2</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-30</td>
<td>Male</td>
<td>6</td>
<td>4</td>
<td>5/8</td>
<td>62.5</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31-40</td>
<td>Male</td>
<td>12</td>
<td>7</td>
<td>10/17</td>
<td>64.7</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>5</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41-50</td>
<td>Male</td>
<td>8</td>
<td>5</td>
<td>8/12</td>
<td>66.66</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51-60</td>
<td>Male</td>
<td>5</td>
<td>4</td>
<td>5/6</td>
<td>83.33</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>61-70</td>
<td>Male</td>
<td>1</td>
<td>1</td>
<td>2/2</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70 and above</td>
<td>Male</td>
<td>1</td>
<td>1</td>
<td>1/1</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>0</td>
<td>0</td>
<td>33</td>
<td>66</td>
</tr>
</tbody>
</table>

Of the 50 cases studied 33 cases showed coronary atherosclerosis. This table shows that coronary atherosclerosis will increase with age and it also shows that males are more affected i.e., 24 cases (72.72%) and females are affected in 9 cases (27.27%). The coronary atherosclerosis was much common in males but after 5th decade it takes the same course in both male and female.

Graph 3: Coronary Atherosclerosis

Of the 50 heart specimens studied 33 showed coronary atherosclerosis with various histological changes such as fibroblastic activity, mucopolysaccharide deposition, degeneration of internal elastic lamina, accumulation of lipid cholesterol crystals, hyalinization, calcification and hemorrhage. Salient features of atherosclerotic lesions
i. Fatty streaks.
ii. Fibrous plaques.
iii. Atheroma.

Histological, examination of representative plaques in the second and third decades showed the presence of fat with little or no cellular reaction. In the 4th and 5th decades, there was generally a fibrous tissue reaction to the presence of fat. By the 5th decade, the fibrous reaction had become more pronounced and was associated with degenerative changes.
**Fig. 1:** Heart along with coronary arteries and aorta upto its bifurcation

**Fig. 2:** Coronary artery showing obliteration of the lumen by atheromatous plaque

**Fig. 3:** Cut section of coronary artery showing atheromas

**Fig. 4:** Atheromatous plaque with complete obliteration of the lumen (Grade IV stenosis) with cholesterol clefts and calcification (H&E x 50)

**Fig. 5:** Atheromatous plaque which shows recanalisation in coronary artery (H&E x 50)

**Fig. 6:** Atheromatous plaque with Grade IV stenosis collagen has stained blue and smooth muscle- red colour (Masson’s Trichrome stain x 50)
IV. DISCUSSION

The autopsy study provides a means of understanding the basic process which sets a stage for clinically significant atherosclerotic cardiovascular disease. There is no valid method of sampling of living population. It was, therefore, considered that deaths suspected due to cardiovascular pathology, probably provide the best sample of the living population for studying atherosclerosis. Many epidemiological studies have brought to light a number of factors that are of indisputable importance in the development of atherosclerosis.

Table 4: Percentage incidence of atherosclerosis in various studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Place</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Wig and associates (1962)</td>
<td>North India</td>
<td>64</td>
</tr>
<tr>
<td>2. Enos et al., (1953)</td>
<td>Korea</td>
<td>77.3</td>
</tr>
<tr>
<td>4. Bhargava and Bhargava (1975)</td>
<td>North Karnataka</td>
<td>69.9</td>
</tr>
<tr>
<td>8. Present Study</td>
<td>Karnataka</td>
<td>66</td>
</tr>
</tbody>
</table>

The percentage incidence of atherosclerosis in various studies ranged from 58% in the study by McGill et al., in United States to 77.3% by Enos et al., among soldiers killed in action in Korea. In present study, the incidence was 66% which was almost comparable to all studies and nearly equal to Wig and Associates, Shirani J et al., studies.

Table 5: Shows age range in different studies in comparison with the present study

<table>
<thead>
<tr>
<th>Study</th>
<th>Age range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Wig and Associates, (1962)</td>
<td>0-80</td>
</tr>
<tr>
<td>2. Enos et al., (1953)</td>
<td>18-48</td>
</tr>
<tr>
<td>3. Subramaniam R. et al., (1964)</td>
<td>2.5-94</td>
</tr>
<tr>
<td>4. Bhargava and Bhargava, (1975)</td>
<td>0-90</td>
</tr>
<tr>
<td>8. Present study</td>
<td>19-80</td>
</tr>
</tbody>
</table>

The age group in above studies varied from neonates to 94 years, whereas in the present study, it was 19 to 80 years. The minimal age was almost equal to Enos et al., Strong J.P. et al., and McGill et al. The maximal age was similar to Wig and Associates and Shirani J. et al.

The prevalence and extent of atherosclerosis quite clearly increased with age. The datas of different studies are compared in Table -8.

Table 6: Comparison of percentage of involvement by atherosclerosis in each decade of life in different studies

<table>
<thead>
<tr>
<th>Decade</th>
<th>Wig and Associates (1962)</th>
<th>Bhargava and Bhargava (1975)</th>
<th>Present study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. with lesions</td>
<td>%</td>
<td>No. with lesions</td>
</tr>
<tr>
<td>&lt; 1 year</td>
<td>-</td>
<td>-</td>
<td>0/13</td>
</tr>
<tr>
<td>1st Decade</td>
<td>2/18</td>
<td>11</td>
<td>2/20</td>
</tr>
<tr>
<td>2nd Decade</td>
<td>7/18</td>
<td>38</td>
<td>2/21</td>
</tr>
<tr>
<td>3rd Decade</td>
<td>24/38</td>
<td>63</td>
<td>12/30</td>
</tr>
<tr>
<td>4th Decade</td>
<td>23/24</td>
<td>95</td>
<td>21/25</td>
</tr>
<tr>
<td>5th Decade</td>
<td>23/25</td>
<td>92</td>
<td>17/21</td>
</tr>
<tr>
<td>6th Decade</td>
<td>19/19</td>
<td>100</td>
<td>10.12</td>
</tr>
<tr>
<td>7th Decade</td>
<td>8/9</td>
<td>88</td>
<td>3/3</td>
</tr>
<tr>
<td>8th Decade</td>
<td>-</td>
<td>-</td>
<td>1/1</td>
</tr>
</tbody>
</table>

In the present study the cases from the first decade were not included as the disease started in the 2nd decade, as stated by Gore et al (1960). Wig and associates observed that atherosclerosis started appearing in teen age itself.
Results of third decade were almost similar to the Wig and Associates, 40% incidence in the Bhargava’s Study which was lesser when compared to present study (66%). The increase of incidence in our study may be due to change of life style of people in recent decades.

After fifth decade almost all the cases in the present study showed the evidence of atherosclerosis. The present study was almost comparable to the above studies in the remaining decades.

**V. Conclusion**

The present study concludes that coronary artery atherosclerosis is common in majority of cases. Atherosclerosis is a complex and multifactorial disease. Age has a dominant influence. Males are affected more than females. Smoking and alcoholism can accelerate the development of atherosclerotic lesions, though they are not atherogenic on their own.

All the observation in the present study showed that the incidence of atherosclerosis in the developing countries (like India) is same as developed countries. There is need of life style change in general public as well as cardiologists and treating physicians to think of early treatment, to avoid untoward complications.

**References**