

ORIGINAL ARTICLE

Percentage Area of Intimal Surface of the Abdominal Aorta affected by Atherosclerosis: A Postmortem Study

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Abstract:

A prospective study was done to find out the macroscopic extent of atherosclerotic lesion of abdominal aorta (above the origin of renal arteries) in Bangladeshi male of different ages. The subjects were divided into lower (8-29), middle (30-40), and higher (42-92) age groups. The atherosclerotic lesions were stained red by treating the aorta with sudden IV. The percentage of area on the intimal surface showing atherosclerotic lesion were measured by AutoCAD. The percentage of area involved in atherosclerotic lesion increased with advancing age. Unpaired student 't' test for statistical analysis revealed significant difference ($p < 0.01$) between lower and higher age groups.

Introduction:

Atherosclerosis is the most common and important pattern of arterial disease, causing thickening and hardening of the arterial wall¹. Despite changes in life style and the use of new pharmacological approaches to lower plasma cholesterol concentration, atherosclerosis and its complications are still the major source of morbidity and mortality in the industrialized world and much of Asia², and estimates have been offered that at its present

rate of growth, it will be the major cause of death by the year 2020 in the world³.

Atherosclerosis refers to a group of disorders that have a common thickening and loss of elasticity of the arterial walls. The fatty streak is the earliest type of lesion, common in infants and young children². Fibrous plaques, which are the most characteristic lesions of advancing atherosclerosis, are not as ubiquitous as fatty streaks in its distribution among populations. Other complications like ulceration, haemorrhage, thrombosis and calcification also vary among populations with respect to age, sex, race, diet and environment⁴. In the aorta, the atherosclerotic lesion appears as fatty streaks as early as in the infancy. It occurs in the aorta of all children irrespective of race, sex or environment by 10 years of age⁵. By age 35 years, this lesion has been found to occupy 30-50% of the aortic surface area⁴. The changes of atherosclerosis initially involve the intimal layer

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of the arterial wall in which there is focal accumulation of a variety of complex lipids, proteins and carbohydrates, cellular components, such as smooth muscle cells and macrophage like cells, blood and blood constituents and in more advanced lesion, high concentrations of mineral, particularly calcium⁶.

In the developing countries like Bangladesh, atherosclerosis and its complications seem to be on the rise. The problem has been aggravated by paucity of the information on the atherosclerotic status of the people. As study of atherosclerosis in the living population is difficult in many ways including its cost-effectiveness, postmortem studies have been regarded as one good way of dealing with the problem. In Bangladesh, such a study has dealt with the thoracic aorta⁷ and with the major secondary epicardial coronary arteries. Regarding abdominal aorta only one study has been done⁶.

The abdominal aorta is involved earliest and most severely by atherosclerotic lesions. So far, only one study on the atherosclerosis in the abdominal aorta in Bangladeshi people has been done. Males suffer more from atherosclerosis related diseases^{1,6}. Considering the seemingly increasing incidence of atherosclerotic disorders in the country, their fatal consequences and the paucity of relevant local data, the present study was carried out to assess the atherosclerotic status of the abdominal aortae of 50 unclaimed cadavers of Bangladeshi males.

Materials and method:

The study was carried out in the Department of Anatomy, Sir Salimullah Medical College, Dhaka during the period of July 2005 to June 2006. Fifty (50) abdominal aortae were collected from unclaimed male dead bodies

autopsied within 48 hours after death to avoid decomposition of the tissue. Collected samples were washed thoroughly in tap water and squeezed gently to remove blood clots from the lumina of the blood vessels as far as possible. Intimal surface of the selected portion of each of the aorta taken for macroscopic study was opened by a longitudinal incision through middle of the anterior wall and flattened by sandwiching it between two sized matched glass slabs kept together by rubber bands. After routine preparation, each aortic segment was stained with sudden IV solution⁹. Sudden IV colored the fatty lesions of intima into red. For taking macroscopic measurement of the atherosclerotic lesions, a transparent plastic sheet was placed on the aortic sample. Then the sheet was fixed on the waxed tray putting pins close to the four corners of the sample. The complete outline of the arterial wall was then traced with a black marker pen (Artline 853 F, Permanent). During outlining the arteries and their lesions, the marker pen was so placed that the outer margin of the outline produced by it was coincided with margins of the arteries and lesions respectively. Then different types of atherosclerotic lesions e.g. fatty streaks, fibrous plaque, calcification were outlined differently with different colour marker pen on the transparent sheet (Figure-1). Thus the total atherosclerotic lesion as well as different types of lesions were measured separately. Then the tracing was ready for measurement of the total surface area of atherosclerotic lesion on the intimal surface. An identical number was put on the traced outline on the transparent sheet. The traced outlines on the transparent sheets were then scanned into computer Microsoft Photo-Editor Programme. The scanned tracings were then

transferred to the AutoCAD (Computer Aided Design) software for measuring the areas covered by the tracing for total area as well as area of different types of atherosclerotic lesions. Measurement was expressed in square

in the present study. It revealed a trend of increase in the mean percentage of atherosclerotic intimal surface area in upper part of the abdominal aorta with advancing age (Table-I). A significant difference

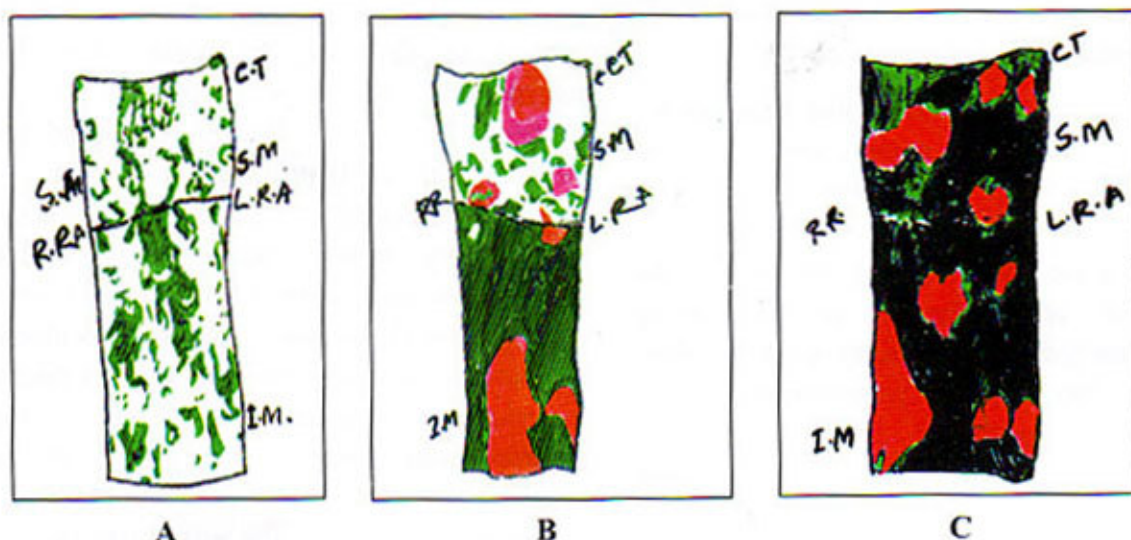


Figure- 1: Representative tracing (from the study notes) of the atherosclerotic lesion in the abdominal aorta of A: the lower age group (8-29 years), B: the middle age group (30-40 years), and C: the higher age group (42-92 years).

millimeters (mm^2).

Results:

There was a general trend of increasing area involvement by atherosclerotic lesions with advancing age. Atherosclerotic lesions were observed in all the aortae of three age groups

($p < 0.01$) in the mean percentage area affected by atherosclerotic lesion was observed between lower and higher age groups. No significant differences were found between middle age group with lower and higher age groups of the aortae.

Table-I: Percentage area of intimal surface affected by atherosclerosis in the upper part* of the aorta

Age group (years)	Number of aortae	Percentage of affected area	
		Range	Mean \pm SD
Lower (8-29)	26	0.56 -100.00	23.66 \pm 23.08
Middle(30-40)	10	1.20 - 69.61	32.07 \pm 22.87
Higher (42-92)	15	8.21-100.00	51.53 \pm 36.89
'p' values		Lower age vs Middle age >0.10 ^{ns} Lower age vs Higher age >0.01 ** Middle age vs Higher age >0.10 ^{ns}	

ns = not significant, ** = significant.

* upper part: extends from upper margin of the origin of coeliac trunk to lower margin of the origin of right and left renal arteries.

Discussion:

A general trend of increasing percentage of lesion with increasing age has been shown in the results of the present study. It was found that the highest values were 100% in lower and higher age group and 69.61% in the middle age group. The lowest age at which atherosclerosis was found in the present study was eight years. It was reported that in a study on whole aorta of 500 Indians from Agra, the earliest lesion was found at the age of 2½ years⁸. Another study on the infrarenal segment of aorta of 50 Bangladeshi males, observed that the earliest lesion being at the age of seven years⁶. It was also demonstrated that lesions were detected even at the age of nine months in an American child⁹. It has been well-documented that the presence of preliminary involvement (usually as fatty streaks) in the first two decades of life does not vary markedly with age, sex, race or environment^{10,11}.

In the present study, sample from a 14 years old boy showed 58.77% affected area. Aortae from two subjects had involvement with atherosclerosis only in upper part and two others had only in the lower part. There was about 17% and 8.5% involvement in the infrarenal aortic segment of a 11 and a 12 years old boy respectively⁶. This rise was around puberty which has been attributed to the possible effect of hormonal changes during puberty⁹. In the present study, a very similar result was found.

In the present study, five subjects out of 15 higher age group people showed 100 percent intimal involvement. Similar trend in result was reported in other studies that upper part of infrarenal aortic segment showed 100% intimal involvement in the subjects belonged

to 52, 60 and 65 years of age⁶. Percentage of area involved showed significant positive correlation with age. Similarity was found in a study on infrarenal segment of abdominal aorta in Bangladeshi males⁶.

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