Original Article

Atherosclerotic Lesions In Relation To Occupational Physical Activity---A Human Autopsy Study

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ABSTRACT

Objective: To assess the severity of different atherosclerotic lesions in relation to occupational physical activity in our population.

Study design: Prospective descriptive observational study.

Place and duration of study: Mortuary of King Edward Medical University Lahore and Department of Pathology Allama Iqbal Medical College Lahore. The duration of study was completed in one and a half year.

Materials and Methods: A total of 130 human autopsies were carried out at random. The age range was between 8 and 85 years. Heart, aorta coronary arteries and renal arteries were collected from dead bodies. One to four areas of tissue were taken from aorta and each arteries in all cases. Sections were prepared from paraffin blocks. These were stained with Haematoxylin and Eosin stain. Special stain were also performed to differentiate all the components of atherosclerotic lesions.

Results: The fatty streaks were present in a predominant number of cases in Grade-II and Grade-III than in Grade-I physically activity cases. The fibrolipid plaques, complicated and classified lesions were seen predominantly in Grade-I than in Grade-II and Grade-III physically active cases on percentage basis.

Conclusion: In this study the severity of different atherosclerotic lesions is noted in Grade-I, Grade-II and Grade-III physically active subjects according to their occupational activities. This basic data gives indication and guideline for prevention and control of atherosclerotic process by increasing physical activity in life style of our population.

Key wards: Physical activity, Atherosclerosis, aorta, Coronary arteries, Renal arteries.

INTRODUCTION

It has been observed that clerks are twice as prone to fatal coronary occlusion than postmen[1]. It was suggested that sustained physical activity above a certain critical threshold was protective against coronary heart disease[2]. It is also reported that 2-4times higher incidence of coronary heart disease and its complications in 5288 middle aged sedentary males when compared to their physically active counterparts[3]. Short bursts of activity repeated several times a day may be equally or more beneficial than prolonged exhaustive exercise. To be effective, physical exercise should be regular and continuous throughout life[4]. It has been shown that coronary proneness in young bus-drivers as compared to young conductors is due to the higher weight and higher lipid levels[5].

MATERIALS AND METHODS

A total of one hundred and thirty human autopsies were carried out during this study. Ninety were males and forty females. The age range was between 8 and 85 years. The autopsies were done in the mortuary of the King Edward Medical University, Lahore.

Selection of Dead Bodies

All the dead bodies included in this study were examined in the interval which ranged from 4-10 hours between the death and autopsy. The dead bodies of men, women and children were included at random i.e on the basis of availability. In each case the relevant history was obtained from the closest relatives of the deceased. Autopsies were performed. The heart, aorta, coronary arteries and renal arteries were included in this study.

Performa for relevant history and autopsy findings.

1. Name
2. Date of birth (Exact/Application)
3. Date of death
4. Sex
5. Place of Residence
6. Occupation.
7. Any Medical Care before death.
8. Mode of death :- Accidental death, non-accidental death
9. Was any diagnosis made before death, if yes, clinical diagnosis.

Heart, aorta, coronary arteries and renal arteries were collected.

Grading of Atheroma

Cross sections of coronary arteries were graded by one of the four scores according to the degree of atheromatous narrowing, Grade-I, upto 25% narrowing, Grade-II, 26-50% narrowing, Grade-III, 51-75% narrowing and Grade-IV greater than 75% narrowing. Complete occlusion with haemorrhage, ulceration, thrombosis and calcification were recorded separately. In addition, major degree of narrowing in each branch was noted; isolated areas of narrowing were specified as "Focal" and distance from origin of artery was noted. In all the 130 autopsies aorta, coronary arteries and renal arteries were examined. 1-4 sections were taken from aorta for histological examination from the following sites.

1. Arch of aorta.
2. Above the celiac artery level (thoracic).
3. At renal arteries level (abdominal)
4. Below renal arteries level (abdominal).

In addition, 1-4 sections from each of the coronary arteries and renal arteries were taken, For histological examination tissue processing was done. On the average 7-8 slides were prepared from each block by taking ribbons of tissue. The paraffin section were stained using Haematoxylin and Eosin stain, von kossa's staining technique, periodic acid Schiff (PAS) reaction, Toludine blue stain and Peral's Prussian blue stain.

RESULTS

The range of physical activity was evaluated from the occupational activities in case of males. In case of females the nature of daily routine house work was interrogated and range of physical activity was considered. In addition to that any other type of physical activity such as exercise or involvement in the games was noted in both males and females.

The different categories of atherosclerotic lesions such as fatty streaks, fibrolipid plaques, complicated (ulceration, haemorrhage and thrombosis) and calcified lesions were noted. Fibrolipid plaques, complicated and calcified lesions were named as the raised lesions. The atherosclerotic ulcers were seen with ragged edges. No case of aneurismal dilatation or rupture of aorta was observed during the study.

In a total of 130 cases in whom aorta, coronary arteries and renal arteries were collected 45 cases showed the history of sedentary habits (Grade-I), 51 cases showed the history of moderate activity (Grade-II) and 34 cases showed the history of strenuous activity (Grade-III). The fatty streaks were present in a predominant number of cases in Grade-II and Grade-III than in Grade-1 physically active cases. The fibrolipid plaques, complicated and calcified lesions were seen predominantly in Grade-I than in Grade-II and Grade-

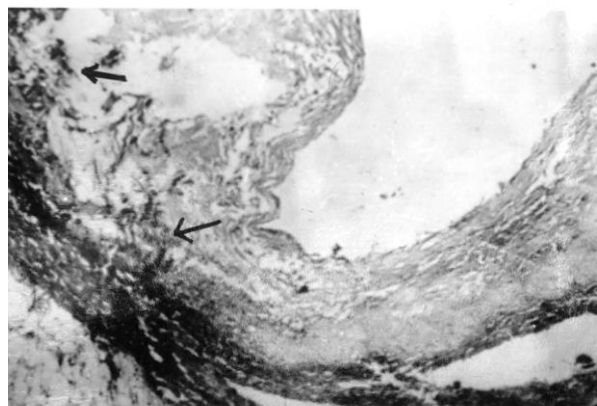III physically active cases on percentage basis. (Table No.1), (Figure No.1).

Figure No.1: Photomicrograph of coronary artery showing atherosclerotic narrowing with denegation of elastic lamina in sedentary subject.

DISCUSSION

In this study the fatty streaks were present in the predominant number of cases in Grade-II and Grade-III Verhoeff's elastic tissue stain x 80 than in grade-I physically active cases. Fatty streaks showed correlation with more physically active cases. The fibrolipid plaques, complicated and calcified lesions were seen in a predominant number of cases in grade-I than in Grade-II and grade-III physically active cases.

Exercise was associated with reduced overall atherosclerotic involvement and it was suggested that moderate exercise may prevent or retard coronary heart disease in primates[6]. It was observed that death due to the coronary atherosclerosis was highest amongst[7]. Supporting these findings declared that those who retired had an 80% greater risk of coronary heart disease than those who had not[8]. It showed that coronary proneness in young bus drivers as compared to young conductors was due to the higher weight and higher lipid levels[5]. After 13 weeks moderate exercise programme there was increase in high density lipoprotein – cholesterol level[9]. It has also been established that increasing the number of miles per weeks increases plasma high density lipoprotein-cholesterol while decreasing levels of low density lipoprotein – cholesterol, very low density low density lipoprotein – cholesterol and percent body fat[10]. It was supported these findings but added that high density lipoprotein – cholesterol level decreases within days of stopping exercises, and high-density lipoprotein-cholesterol have an independent protective effect on ischemic heart disease[11,12,13]. On the other hand it is suspected that there was no effect of exercise on serum cholesterol level[14].

During physical activity, the output of cholesterol and bile acids in the bile increases. This causes higher

faecal loss of sterols which may lead of lower cholesterol levels in peripheral tissues and in the bile. There is also release of unsaturated fatty acids from the adipose tissue during exercise alongwith linoleic acid dependent LCAT enzyme[4]. On the other hand it is indicated that classical risk factors for coronary heart disease do not improve with increased physical activity and fitness[15].

Table No.1: Number and percentage distribution of atherosclerotic lesions in aorta, coronary arteries and renal arteries in relation to history of occupational physical activity

Blood vessels	Fatty streaks IN						Fibrolipid Plaques IN						Complicated lesions IN						Calcified lesions IN					
	I		II		III		I		II		III		I		II		III		I		II		III	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No	%	No	%	No.	%	No.	%	No.	%	No.	%
Thoracic Aorta	22	48.9	38	74	20	58.8	22	48.9	13	25.5	6	17.6	11	24.4	7	13.7	3	8.8	6	13.3	3	5.9	1	3..0
Abdominal Aorta	17	37.8	31	60.8	14	41.2	42	93.3	24	47.1	13	38.2	26	57.8	16	31.4	7	20.6	14	31.1	8	15.7	4	11.8
Anterior descending LT. C.A	4	9.0	10	19.6	5	14.7	37	82.2	23	45.1	9	26.5	10	22.2	6	11.8	2	5.9	3	6.7	2	3.9	-	-
Circumflex Lt. C.A	3	6.7	8	15.7	4	11.8	37	82.2	24	47.1	12	35.3	5	11.1	3	5.9	1	3.0	1	2.2	-	-	-	-
Rt. C.A	-	-	2	3.9	1	3.0	3	6.7	2	3.9	1	2.9	1	2.2	-	-	-	-	-	-	-	-	-	-
Rt Renal Artery	8	17.8	21	41.2	12	35.3	18	40.0	10	19.6	4	11.8	9	20.0	5	9.8	1	3.0	6	13.3	3	5.9	-	-
Lt. renal artery	8	17.8	21	41.2	12	35.3	10	22.2	7	13.7	3	8.8	7	15.6	3	5.9	1	3.0	5	11.1	2	4.0	-	-
Rt. Common iliac artery	-	-	7	58.3	4	50.0	10	100	7	58.3	4	50.0	9	90.0	5	41.7	1	12.5	6	60.0	3	25.0	1	12.5
Lt. common iliac	-	-	7	58.3	4	50.0	10	100	7	58.3	4	50.0	7	70.0	5	41.7	1	12.5	5	50.0	3	25.0	1	12.5
Mean incidence in all vessels		15.3		41.4		33.3		63.9		35.4		26.7		34.8		17.9		7.7		20.8		9.4		4.4

I = Sedentary   II = Moderate activity   III = Strenuous Activity.

It has been established that physical activity and exercise training have important roles in preventing atherosclerotic coronary artery disease. Managing select Coronary artery disease risk factors, including elevated triglyceride levels, low HDL-C. hypertension, glucose intolerance, hypertension, obesity, and possibly cigarette use. Treating patients with coronary artery disease, heart failure and claudicating[16,17]. It has also bee seen that exercise training results in a faster heart rate recovery in patients with heart failure, heart rate recovery, as a simple marker of rehabilitation[18]. A regular physical activity program reduces BP, arterial stiffness, and abdominal fat; increases curio respiratory fitness; and delays arterial wall remodeling in pre-pubertal obese children[19]. On the other hand it has been seen that Cardiopulmonary exercise testing with gas exchange measurements in likely to be a value in diagnosing and quantifying both overt and occult myocardial ischemia and its reversibility with treatment[20,21]. Again it is also suggested that physical activity was weakly associated with a reduced risk of ischemic stroke among middle-aged adults. The association may be due to links between physical activity and other risk factors or due to chance[22,23]. But in a comparative study it is established that the earlier age of acute myocardial infarction is South Asians can be largely explained by higher risk factor levels at younger ages[24]. A recent study from 2 Indian cities indicates that daily moderate intensity exercise such as brisk walking from 35 to 40 minutes was associated with more than a 50% reduction in risk for CHD. Physical activity increased insulin sensitivity and high density lipoprotein cholesterol, lowers blood pressure, improves endothelial function, and reduces the risk of type 2 diabetes mellitus, hypertension, and central adiposity, these risk factors are highly prevalent in South Asians. Hence, there is an urgent need to promote moderate-intensity physical activity for South Asians[25-29].

CONCLUSION

In this study the severity of different atherosclerotic lesions is noted in Grade-I, Grade-II and Grade-III physically active subjects according to their occupational activities. This basic data gives indication and guideline for prevention and control of atherosclerotic process by increasing physical activity in life style of our population.

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