Original Article

Morphology and Incidence of Atherosclerotic Lesions in Subclavian Arteries - A Human Autopsy Study

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ABSTRACT

Objective: To assess different morphological categories of atherosclerotic lesions and their incidence in relation to age and sex in our population

Study Design: Prospective descriptive observational study.

Place and Duration of Study: This study was conducted at Mortuary of King Edward Medical University Lahore and Department of Pathology Allama Iqbal Medical College Lahore and completed in one and a half year from

Material and Methods: A total of 30 human autopsies were carried out at random. The age range was between 8 and 85 years. Right and Left subclavian arteries were taken out from dead bodies. They were opened lengthwise. One to four areas of tissue were taken from each artery in all cases. Section were prepared from paraffin blocks. They were stain with Haematoxylin and Eosin stain. Special stains were also performed to differentiate all the components of atherosclerotic lesions.

Results: The fibrolipid plaques were seen in 13 cases in the right subclavian artery and 13 cases in left subclavian artery. The complicated lesions were seen in 8 cases in the right subclavian artery and 9 cases in the left subclavian artery. 6 of these 8 cases showed ulceration in the right subclavian artery and 2 showed intimal vascularization and haemorrhage alongwith thrombus formation. In the left subclavian artery the ulceration was seen in 7 cases and intimal vascularization and haemorrhage in 2 cases alongwith thrombus formation. The calcified lesions were present in 7 cases in the right subclavian artery and 8 cases in the left subclavian artery. The morphological changes in media and elastics were seen in 7 cases in right subclavian artery and 8 cases in left subclavian artery.

Conclusion: In this study different atherosclerotic lesions are categorized and their relation to age and sex is appreciated in our population. This study is although is preliminary but gives basic and useful data about the incidence of ischemic changes in upper limbs due to raised atherosclerotic lesions in subclavian arteries.

Key Words: Atherosclerosis, subclavian, arteries, lesions.

INTRODUCTION

Depolymerisation of acid-mucopoly saccharides involved in the plaque formation results in the loss of metachormasia of the ground substance. After that the visible fibers crumble and dissolve completely and it is replaced by lipid droplets and cholesterol[1]. In ulcerated atheroma extensive foam cell are formed that are connected by fibrin- mesh[2]. Intimal thickening causes hypoxia of mid-zone of media .this provides the stimulus for the ingrowth of capillaries from the adventitial vessels into the thickened intima. Thrombosis may occur on an ulcerating atheroma[3]. In atherosclerosis fine granules of Calcium appear in the ground substance and the necrotic tissues at the marginal layer of ulcers. The relative attenuation of the media is due to the disintegration of the elastic fiber system in the inner layer of the medial coat[4].

MATERIAL AND METHODS

A total of thirty human autopsies were carried out during this study . The autopsies were done in the Mortuary of the King Edward Medical College, Lahore. Right and left subclavian arteries were taken out and opened lengthwise. One to four sections were taken from each subclavian artery for histological examination. Tissue processing was done. On the average 7-8 slides were prepared from each block by taking ribbons of tissues . The paraffin sections were stained using Haematoxylin and Eosin stain, Curtis's Picro-ponceau stain, Verhoeff's elastic tissue stain, von kossa's staining technique, periodic acid Schiff (PAS) reaction, Toludine blue stain and Peral's Prussian blue stain.

RESULTS

Gross Appearances: The fatty streaks were present in 11 of the 30 cases in the right subclavian artery and 11 of the 30 cases in the left subclavian artery. They were distributed along the long axis of the vessel wall. The fibrolipid plaques were present in 19 cases in the right

subclavian artery and 20 cases in the left subclavian artery. The complicated lesions were seen in 8 cases in the right subclavian artery and 9 cases in the left subclavian artery. In the right subclavian artery 6 cases showed ulceration whereas intimal vascularization and haemorrhage in 2 cases. In left subclavian artery the ulceration was present in 7 cases and intimal vascularization and haemorrhage in 2 cases. No thrombus formation was seen. The calcified lesions were present in 8 cases in the left subclavian artery and 7 cases in right subclavian artery. The number of raised lesions in the right subclavian artery were 1-2 whereas in the left subclavian artery they were 2-3. Size of the largest raised lesion was 3x4 mm and size of the smallest raised lesion was 3x3 mm. the colour or the fatty streaks was yellow, whereas that of the fibrolipid plaques was yellow to yellowish white. The complicated lesions were yellowish grey and the calcified lesions were yellowish back. The raised lesions were distributed irregularly within 1cm of the beginning of the right subclavian artery and of the Ostia in left subclavian artery in these cases (Table No.1).

Microscopical changes: Fatty streaks were present in 11 cases in the right subclavian artery and 11 cases in the left subclavian artery. The fibrolipid plaques were seen in 13 of the 19 cases found on gross examination in the right subclavian artery and 13 of the 20 cases found on gross appearance in the left subclavian artery. The complicated lesion were seen in 8 cases in the right subclavian artery and 9 cases in the left subclavian artery. 6 of these 8 cases showed ulceration in the right subclavian artery and 2 showed intimal vascularization and haemorrhage alongwith thrombus formation. In the left subclavian artery the ulceration was seen in 7 cases and intimal vascularization and haemorrhage in 2 cases alongwith thrombus formation. The calcified lesion were present in 7 cases in right subclavian artery and 8 cases in the left subclavian artery. The morphological changes in media and elastica were seen in 7 cases in right subclavian artery and 8 cases in left subclavian artery.

On histological examination of the fatty streaks the foam cells alongwith the increase of fluid was present in the intima. Lipid was present both intracellular and extracellular alongwith the connective tissue changes. The fibrolipid plaques showed fibrous degeneration and regeneration with mucoid changes. There was a metachromatic change and hyalinization in the atherosclerotic lesion (Figure No.1). Number of foam cells was prominent and the number of fibrocytes was also increased. The fat was present in the foam of fatty pool and the needle-shaped cholesterol crystal clefts were also demonstrated. Variable number of foam cells was present with the necrotic area at the vase of the lesion. In ulcerated lesions the lipid contents were less in amount. Foam cells with fibrin was present abundantly. A lymphocytic reaction with granulation tissue were seen in the lesion. In cases showing intimal vascularization and haemorrhage, there was neo-vascularization in the intima. In addition to that the red blood cells and haemosiderin deposits were also present at the junction of media and atherosclerotic lesions. In atherosclerotic lesions showing thrombus formation the fibrin strands were present at the periphery and in between the platelet aggregate. The calcified messes were deposited in degenerated debris and hyalinized collagen tissue in the intima. Deposits of calcium were particularly present around the necrotic areas, lipid pool and marginal layers of ulcers in atherosclerotic lesions.

The medial coat was relatively attenuated below the sclerotic plaque and was one half or less of the thickness of the media in the adjacent part of the artery. The fibers on the inner third of media were severely degenerated. The fragmented internal elastic lamina was separated apart and was totally deficient over wide areas at the base of large plaques (Figure No. 2), (Table No. 2).

Table No. 1: Atherosclerotic Lesions in Subclavian Arteries in Relation to Age And Sex (Gross Findings) (30 Cases)

Age in years	Fatty Streaks		Fibrolipid Plaques		Complicated Lesions		Calcified Lesions	
	R	L	R	L	R	L	R	L
	M:F	M:F	M:F	M:F	M:F	M:F	M:F	M:F
6-15	-	-	-	-	-	-	-	-
16-25	-	-	-	-	-	-	-	-
26-35	3:2	3:2	2:1	2:1	-	-	-	-
36-45	3:3	3:3	4:1	5:1	-	-	-	-
46-55	-	-	3:0	3:0	-	-	-	-
56-65	-	-	4:2	4:2	2:0	2:0	2:1	3:3
66-75	-	-	1:1	1:1	1:5	1:6	3:1	1:1
Total	6:5	6:5	14:5	15:5	3:5	3:6	5:2	4:4
%age	20: 16.66	20: 16.66	46.66: 16.66	50: 16.66	10: 16.66	10:20	16.66: 6.66	13.33: 13.33

Table No. 2: Aherosclerotic Lesions in Subclavian Arteries in Relation to Age and Sex (Microscopic Findings) (30 Cases)

Age in years	Fatty Streaks		Fibrolipid Plagues		Complicated lesions		Calcified Lesions	
	R	L	R	L	R	L	R	L
	M:F	M:F	M:F	M:F	M:F	M:F	M:F	M:F
6-15	-	-	-	-	-	-	-	-
16-25	-	-	-	-	-	-	-	-
26-35	3:2	3:2	2:1	2:1	-	-	-	-
36-45	3:3	3:3	2:1	2:1	1:0	2:0	1:0	1:0
46-55	-	-	1:0	1:0	1:0	1:0	1:0	1:0
56-65	-	-	3:1	3:1	3:1	3:1	2:1	3:1
66-75	-	-	1:1	1:1	1:1	1:1	1:1	1:1
Total	6:5	6:5	9:4	9:4	6:2	7:2	5:2	6:2
%age	20: 16.66	20: 16.66	30: 13.33	30: 13.33	20: 6.66	23.33: 6.66	16.66: 6.66	20: 6.66

R= Right, L = Left

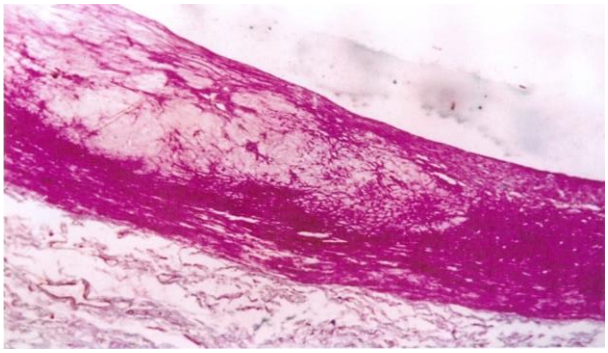

Figure No. 1: Photomicrograph of subclavian artery showing hyalinization and fibroblastic proliferation. Haematoxylin and Eosin x 520

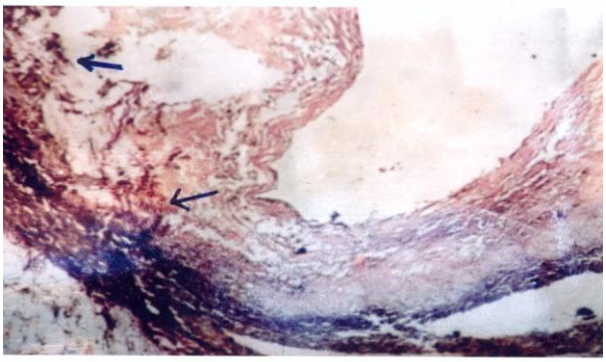

Figure No. 2: Photograph of subclavian artery showing marked degeneration of elastic fibers (arrow) with regeneration at the periphery. Media is attenuated under the plaque. Verhoeff's elastic stain x 80

DISCUSSION

Gross morphology of Atherosclerotic lesions: The fatty streaks were distributed along the long axis of the vessel wall. The number of raised lesions in the left subclavian artery were 1-2 whereas in the left subclavian artery they were 2-3. Size of the largest raised lesion was 3x4 mm and size of the smallest raised lesion was 3x3 mm. the colour of the fatty streaks was yellow, where as that of the fibrolipid plaques was yellow to yellowish white. The complicated lesions were yellowish grey and the calcified lesions were yellowish black. The raised lesions were distributed irregularly within 1cm of the beginning of the right subclavian artery and of the Ostia in left subclavian artery in these cases.

Microscopic Appearance of Atherosclerotic Lesions. On the light microscopy, the fatty streaks showed the presence of foam cells beneath the endothelial lining. There was increase of fluid in the ground substance. In addition to these changes, the connective tissue was arranged in the form of loose mesh with some fibrin deposition[5]. It seems likely that lipoproteins are transported across intact endothelial cells by micro-pinocytosis[6]. Lipid was present both intra- cellularly and extra-cellularly. Foam cells are smooth muscle cells containing lipids . Probably local adherence of the platelets at the endothelium releases Mitogenic platelets to the endothelium releases Mitogenic Platelet factors into the arterial wall and causes some intimal smooth muscle cells proliferation[7]. In fibro-lipid plaques both connective tissue and lipid changes were prominent. These changes were visible as mucoid swelling due to the presence of protein molecules and acid-mucopolysaccharides. In addition there was a metachromatic change in the ground substance alongwith hyalinization . This change has previously been related to the increased amount of the ground substance[2]. Alteration in intrinsic composition and molecular size of proteoglycans occurs in atherosclerotic lesion[8]. The increase in the number of foam cells in fibrolipid plaques was probably due to increase in the smooth muscle cell proliferation and vacuolated forms[9]. In such vacuolated cells the lipid containing inclusions have been associated with the structural elements of smooth muscle cells[10]. Foam cells accumulation have been demonstrated in experimentally induced atherosclerosis[11]. The number of fibrocytes is increased during plaque formation. It is associated with increased formation of collagen and

elastic fibers. These connective tissue components are probably derived from the proliferating smooth muscle cells in the intima. There was high concentration of fibrin in developing atherosclerotic lesion[8]. It was established that there is an association between accumulation of fibrin and binding of low density lipoproteins (LDL)[12]. On the other hand it was proposed that the process of smooth muscle cell proliferation is related to the tumour formation initiated by mutation . The lipids were seen in the form of fatty pool and needle-shaped cholesterol Crystal clefts[13,14]. LDL is important to the initiation and probably the progression of atherosclerotic lesions[15,16]. In the ulcerated lesions the lipid contents were markedly less in amount . On the other hand foam cells were extensively present at the base and fibrin was seen intervening these cells[2]. The blood vessels were found in the intima. RBCs and haemosiderin deposits were present at the junction of media and atherosclerotic lesion. It was also explained that neo-vascularization in the intima may lead to haemorrhage because they run the tissue that does not support them adequately[4]. In thrombus formation Platelet aggregation at the exposed sub endothelial tissue was seen . The fibrin strands were present at the periphery and in between the platelet aggregates. The collagen rich atherosclerotic lesion initiates thrombosis, because it exposes the blood to powerful platelet aggregating (collagen), and coagulation activating (traumatic surface and lipids) factors that are not found in normal vessel wall. Fibrinogen leads to the Platelet aggregation associated with release of vasoconstrictor , thromboxane A2. This hyper coagulibility of platelets again is associated with hyper fibrinogenaemia and thrombosis . Lack of PG12 due to endothelial injury may lead to thrombus formation, because PG12 is powerful anti-aggregating vasodilator[12]. Contrary to above mentioned observations it was described that Fibrous plaque is fibrinoid or organized thrombus[4] This study was supported by the observations that calcified granules were presented around the degenerated debris and hyalinized collagen tissue in the intima[17]. They also observed that deposits of calcium were particularly present at the periphery of necrotic areas, lipid pool and marginal layer of ulcers in atherosclerosis. The fibers on the inner third of media were severely degenerated. Internal elastic lamina was fragmented and was totally deficient over wide areas at the base of large plaques due to rigid pressure[1].

CONCLUSION

In this study different atherosclerotic lesions are categorized and their relation to age and sex is appreciated in our population. This study is although is preliminary but gives basic and useful data about the incidence of ischemic changes in upper limbs due to raised atherosclerotic lesions in subclavian arteries

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