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Coronary Arterial Lipid and Carbohydrate-A Histochemical Study

Anatomy

KEYWORDS : Carbohydrate, Lipid, Circumflex artery, Interventricular artery, Coronary artery

Dr. Keshaw Kumar

Department of Anatomy, Government Allopathic Medical College Banda (U.P.) INDIA

ABSTRACT

During autopsy tissue of circumflex and interventricular arteries was obtained at constant levels from 50 human adults showing right coronary arterial dominance to compare density of metabolic storage products (lipid and carbohydrate) in coronary arterial wall layers histochemically after knowing history from their relatives that they were not suffering from any cardiovascular disease.

Tissue was preserved in 10% formalin (for carbohydrate) and Baker's Calcium Cadmium Formol Solution-1944 (for lipid). Paraffin sections of 10 micron thickness were stained with PAS (for carbohydrate) and Sudan Black-B (for lipid).

Right circumflex and posterior interventricular arteries showed density of reaction product of lipid/carbohydrate ++++ in tunica adventitia, + in tunica media and + in tunica intima while in left circumflex and anterior interventricular arteries density of reaction product of lipid/carbohydrate was observed ++++ in tunica adventitia, ++ in tunica media and +++ in tunica intima.

INTRODUCTION

Ahmed and Mohiuddin (1963)[1] observed metachromatic ground substance of normal aortic tunica media. Braunstein (1960)[2] performed histochemical study of adult aorta. Bunting and Bunting (1953)[3] noticed acid mucopolysaccharides of the aorta. Mucopolysaccharides of human arterial tissue were reported by Dyrbye and Kirk (1957)[4], Dyrbye, Kirk and Wang (1958)[5], Kirk and Dyrbye (1957)[7], Kirk Wang and Dyrbye (1958)[6]. Keshaw Kumar (1996, 2003)[8,12] described anatomy of human coronary arterial lipid accumulation. Somer and Schwartz (1971)[10] studied focal-H-cholesterol in pig aorta.

Present study is conducted to compare the density of metabolic storage products (lipid and carbohydrate) histochemically in tunica intima, tunica media, tunica adventitia of circumflex and interventricular branches of right and left human coronary arteries, which is not reported in the literature as yet.

MATERIAL AND METHODS

Hearts of 50 human adults with right coronary arterial dominance were procured immediately after death due to accidents after knowing the history from their relatives that they were not suffering from any cardiovascular disease. Circumflex and interventricular branches of right and left human coronary arteries were dissected in all the hearts and 0.5cm. long arterial segments were obtained from the following sites.

1. Right circumflex artery 1 cm distal to its commencement.
2. Left circumflex artery 1 cm distal to its commencement.
3. Anterior interventricular artery 2 cm distal to its commencement.
4. Posterior interventricular artery 0.5 cm distal to its commencement.

The above mentioned sites of the coronary arteries are the sites commonly effected during atherosclerosis as reported by Gross et.al (1934)11. Tissue from 25 human adults was preserved in 10% formalin (for carbohydrate) and tissue from remaining 25 human adults was preserved in Baker's Calcium Cadmium Formol Solution-1944 (for lipid). After processing paraffin sections of 10 micron thickness were cut with the help of rotary microtome to be stained with Periodic Acid Schiffs (for carbohydrate) and Sudan Black-B (for lipid). Density of reaction product of lipid and carbohydrate per magnified field was observed in tunica intima, tunica media and tunica adventitia of circumflex and interventricular branches of right and left coronary arteries.

Each layer of coronary arteries was graded as +, ++, +++ and ++++ for density of reaction product of lipid as well as carbohydrate with + representing minimum density and ++++ representing maximum density. Results were obtained as visual assessment by a single observer.

OBSERVATIONS

1.CARBOHYDRATE (Table-I, Fig-1 & 2)

A-Circumflex arteries:- Density of reaction product of carbohydrate was observed ++++ in tunica adventitia, ++ in tunica media and +++ in tunica intima of left circumflex artery while right circumflex artery showed density of reaction product of carbohydrate ++++ in tunica adventitia, + in tunica media and + in tunica intima.

B-Interventricular arteries:- Density of reaction product of carbohydrate was observed ++++ in tunica adventitia, ++ in tunica media and +++ in tunica intima of anterior interventricular artery while posterior interventricular artery showed density of reaction product of carbohydrate ++++ in tunica adventitia, + in tunica media and + in tunica intima.

2. LIPID (Table –II, Fig. 3 & 4)

A. Circumflex arteries:- Density of reaction product of lipid was observed ++++ in tunica adventitia, ++ in tunica media and +++ in tunica intima of left circumflex artery while right circumflex artery showed density of reaction product of Lipid ++++ in tunica adventitia, + in tunica media and + in tunica intima.

B. Interventricular arteries:- Density of reaction product of lipid was observed ++++ in tunica adventitia, ++ in tunica media and +++ in tunica intima of anterior interventricular artery while posterior interventricular artery showed density of reaction product of Lipid ++++ in tunica adventitia, + in tunica media and + in tunica intima.

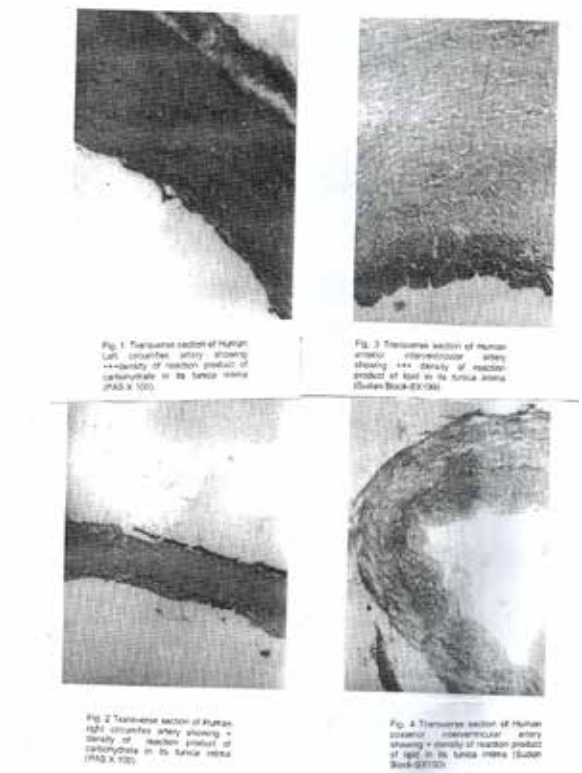
Table-I

Density of reaction product of carbohydrate in human coronary arteries

Arteries	Tunica intima	Tunica media	Tunica adventitia
Right circumflex artery	+	+	++++
Left circumflex artery	+++	++	++++
Anterior interventricular artery	+++	++	++++
Posterior interventricular artery	+	+	++++

Table-II
Density of reaction product of lipid in human coronary arteries

Arteries	Tunica intima	Tunica media	Tunica adventitia
Right circumflex artery	+	+	++++
Left circumflex artery	+++	++	++++
Anterior interventricular artery	+++	++	++++
Posterior interventricular artery	+	+	++++



DISCUSSION

Left coronary arterial pulse pressure is thrice more than the right coronary arterial pulse pressure (Keshaw Kumar 2003,2009)[9,16] due to which density of reaction product of carbohydrate/lipid is thrice more in tunica intima of left coronary artery than the density of reaction product of carbohydrate/lipid in tunica intima of right coronary artery as has been observed in the present study. Findings regarding density of reaction product of lipid in the interventricular arteries in present study resemble with the findings of density of reaction product of lipid in interventricular arteries reported by Keshaw Kumar (1996,2003,1994,2009,2014)[8,12,13,17,18]

According to Gross, et. al. (1934)11 anterior interventricular artery is the most effected artery and posterior interventricular artery is the least effected artery by atherosclerosis. +++ density of reaction product of lipid in tunica intima of anterior interventricular artery and + density of reaction product of lipid in tunica intima of posterior interventricular artery observed in present study supports the findings of Gross, et. al. (1934)[11] and confirms the theory of atherosclerosis i.e. "tunica intimal density of lipid in an artery is directly proportional to pulse pressure of blood flowing in the lumen of that artery" put forth by Keshaw Kumar (1994, 1996, 2003) [13,8,12]. +++ density of reaction product of lipid supports the findings of Gross, et.al. (1934)[11] who reported that deposition of lipid and calcium salts starts in tunica intima of anterior interventricular artery in early age. Carbohydrate and lipid both are metabolic storage products, therefore density of their reaction products resemble with each other in different layers of right and left coronary arteries depending upon the pulse pressure of blood there.

Tunica intimal accumulation of carbohydrate also takes place like the tunica intimal accumulation of lipid reported by Keshaw Kumar (1994, 1996, 2003)[13,8,12], supporting the mechanism of lipid accumulation described by Harvey (1963)[14], Spiro and Weiner (1963)[15]. On the basis of the findings in the present study the tunica intimal accumulation of metabolic storage products (carbohydrate and lipid) in the human coronary arteries can be established as follows-

Pulse pressure of blood is directly proportional to pinocytotic activity of endothelial cells of tunica intima which is directly proportional to amount of metabolic storage products (carbohydrate and lipid) entering in tunica intima which is directly proportional to relative inadequacy of metabolic removal of metabolic storage products (carbohydrate and lipid) from tunica intima which is directly proportional to atherogenesis. Keshaw Kumar (2003, 2009) [9,16] reported left coronary arterial pulse pressure 60mm Hg and right coronary arterial pulse pressure 20mm Hg in the persons with right coronary arterial dominance. According to Keshaw Kumar (1994, 1996, 2003)[13,8,12], tunica intimal density of lipid in an artery is directly proportional to pulse pressure of blood flowing in the lumen of that artery but on the basis of results obtained in the present study it is concluded that tunica intimal density of metabolic storage products (lipid and carbohydrate) in an artery is directly proportional to pulse pressure of blood flowing in the lumen of that artery as reported by Keshaw Kumar (2009, 2014)[17,18].

REFERENCES

1. Ahmed, M.M., and Mohiuddin, A. Metachromatic ground substance of normal aortic media at different ages of Chinese subjects. Med. J. Malaya (1963) 17: 199-208.
2. Brounstein, H. Histochemical study of adult aorta. Arch. Path. (1960) 69: 617-632.
3. Bunting, G.H. and Bunting, H. Acid mucopolysaccharides of the aorta, Arch. Path. (1953), 55 : 257-264.
4. Dyrbye, M., Kirk, J.E. Mucopolysaccharides of human arterial tissue. I. Isolation of mucopolysaccharides material. J. Gerontol., (1957), 12: 20.
5. Dybye, M., Kirk, J.E. and Wang I. Mucopolysaccharides of human arterial tissue. III. Separation of fractions by proper electrophoresis. J. Gerontol., (1958), 13: 149.
6. Kirk, J.E., Wang I., and Dyrbye, M. Mucopolysaccharides of human arterial tissue, IV. Analysis electrophoretically separated fractions. J. Gerontol, (1958), 13 : 362.
7. Kirk, J.E., and Dyrbye, M. Mucopolysaccharides of human arterial tissue, II. Analysis total isolated mucopolysaccharide material. J. Gerontol, (1957), 12 : 23.
8. Keshaw Kumar, Increasing pulse pressure of blood-A cause of atherosclerosis in arteries, Journal of Anatomical Sciences (1996), Vol. 15 (I) 15-19.
9. Keshaw Kumar, Anatomy of human coronary arterial pulsation. Journal of Anatomical Society of India. (2003), Vol. 52 (I) 24-27.
10. Somer, J.B., and C.J. Schwartz. Focal-H-Cholesterol uptake in the pig aorta. Atherosclerosis (1971), Vol. 13: 293-304.
11. Gross, L. Epstein, E.Z. Kugel, M.A. Histology of coronary artery and their branches in human heart Am. J. Path (1934), 10: 253-274.
12. Keshaw Kumar Anatomy of human coronary arterial lipid accumulation. Journal of Anatomical Society of India (2003), Vol. 52 (2) 147-149.
13. Keshaw Kumar, Histochemical study of ascending aorta and pulmo-

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nary trunk in different mammals. Vijnana Parishad Anusandhan Patrika (1994) Vol. 37 (2): 139-144.

14. Harvey, F., Watts, M.D. The mechanism of arterial lipid accumulation in human coronary artery atherosclerosis: Coronary Heart Disease, (1963) P-98.
15. Spiro, D. and Joseph, Weiner, M.D. Fine structure of coronary artery. Coronary Heart Disease, (1963) P-11.
16. Keshaw Kumar, coronary arterial pulse pressure in right and left coronary arterial dominance. Anatomica Karnataka. (2009) Vol. 3 (3): 17-23.
17. Keshaw Kumar, Histochemical study of human coronary arteries. Journal of Anatomical Sciences (2009), Vol. 17 (2) 60-65.
18. Keshaw Kumar, Pulse pressure of blood flowing in lumen of an artery is directly proportional to tunica intimal density of lipid as well as carbohydrate of that artery. The theory of atherosclerosis created. International Journal of Scientific Research (2014) Vol. 3 (12) 52-55.