Deviation/Alteration of " Keshaw Constants" is the Exact Cause of Increased Incidence of Coronary Heart Disease in Persons With Left Coronary Arterial Dominance.

Medical Science

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ABSTRACT
In order to prove the deviation/alteration in "Keshaw Constants" in coronary arteries as the exact cause of increasedincidence of coronary heart disease in persons with left coronary arterial dominance wall (tunica media) thickness and lumen circumference of both the coronary arteries were measured during autopsy in 90 human adults (45 with right coronary arterial dominance and 45 with left coronary arterial dominance) who had no history of suffering from any cardiovascular disease.Pulsatory power, pulse pressure and volume of blood entering the coronary arteries during each heart beat were calculated according to laws of arterial pulsation (Keshaw Kumar, 1993, 2015)1,2.
It was observed that in persons with right coronary arterial dominance "Keshaw Constants" were existing in their coronary arteries in the ratios (3:1 and 1:1) while in the persons with left coronary arterial dominance there was deviation/alteration of "Keshaw Constants" in their coronary arteries in the ratios (4:1 and 1:1) proving that deviation/alteration of "Keshaw Constants" is the exact cause of increased incidence of coronary heart disease in persons with left coronary arterial dominance.

INTRODUCTION

Blumgart et. al. (1940)[3], White (1951)[4], Mathur (1957)[5] and All-work (1987)[6] reported increased incidence of coronary heart disease in persons with left coronary arterial dominance. Schlesinger (1940)[7] found relation of anatomic pattern to pathologic conditions of the coronary arteries. James (1965)[8] noticed anatomy of coronary arteries in health and disease. Keshaw Kumar (1993, 2015) [1, 2] calculated pulsatory power of human arteries and created three laws of arterial pulsation. Keshaw Kumar (1996, 2003)[9,10] established increasing pulse pressure of blood as a cause of arterial atherosclerosis and described anatomy of human coronary arterial lipid accumulation. Keshaw Kumar (2003, 2009, 2015)[11,12,13] studied coronary arterial pulsation, pulse pressure, "Keshaw Constants" and "Keshaw concept of blood volume equality". Keshaw Kumar (2007, 2008)[14,15] compared anatomy of systemic circulation with anatomy of pulmonary circulation and interrelated coronary heart disease with coronary arterial pattern. Keshaw Kumar (2014, 2015)[16,17] reported existence and deviation/alteration of Keshaw Constants in coronary arteries of domestic mammals and created theory of atherosclerosis.

Present study was conducted to prove the alteration/deviation of "Keshaw Constants" as the exact cause of increased incidence of coronary heart disease in persons with left coronary arterial dominance which was not available in literature as yet.

MATERIAL AND METHODS

During autopsy arterial segments of right coronary artery and left coronary artery were obtained 1 cm distal to their commencements to be preserved in 10% formalin in 45 human adults with right coronary arterial dominance (RCAD Group) and 45 human adults with left coronary arterial dominance (LCAD Group) who had no history of suffering from any cardiovascular disease.

Lumen circumference was measured in all the arterial segments by cutting their walls longitudinally. Paraffin sections of 10 micron thickness of all the arterial segments were stained with orcein (RCAD Group) and PAS (LCAD Group) to obtain 100 times magnified photomicrographs of all the stained sections. In all the photomicrographs thickness of tunica media was measured between internal elastic lamina and external elastic lamina. Mean of the lumen circumference and mean of the thickness of tunica media were calculated for the right coronary artery and left coronary artery separately in RCAD group and LCAD group. Later on actual thickness of tunica media was obtained after dividing the mean thickness of tunica media of photomicrographs by 100 because photomicrographs were taken at 100 times magnification.

Pulsatory power, pulse pressure, and volume of blood entering the lumen of coronary arteries during each heart beat were calculated according to following laws of arterial pulsation created by Dr. Keshaw Kumar (1993, 2015)[1,2].

1. Pulsatory power of an artery is equal to pulse pressure multiplied by volume of blood entering the lumen of that artery during each heart beat.
2. Wall (tunica media) thickness of an artery is directly proportional to pulsatory power of that artery having 1mm wall thickness is reported as 2000 Joule per heart beat.
3. Lumen circumference of an artery in millimeters equals with the volume of blood in milliliters, entering the lumen of that artery during each heart beat.

OBSERVATIONS

Left Coronary Arterial Dominance (LCAD Group)

Mean thickness of tunica media in 100 times magnified photomicrographs of left coronary artery was 32 mm (fig-1) while the mean thickness of tunica media in 100 times magnified photomicrographs of right coronary artery was 8 mm (fig-2). Therefore after dividing above mentioned mean thickness by 100 the actual mean thickness of tunica media in case of left coronary artery was obtained 0.32 mm while in case of right coronary artery it was obtained 0.08 mm (Table-I) showing the ratio of 4:1 which was present not only between their pulsatory powers i.e. 640 Joule per heart beat in left coronary artery and 160 Joule per heart beat in right coronary artery (Table-I and II) but also between their pulse pressures of blood i.e. 64 mm of Hg in left coronary artery and 16 mm of Hg in right coronary artery (Table-II).

Table-I

Proportion between pulsatory power/tunica media thickness of coronary arteries in left coronary arterial dominance (LCAD) group

Arteries	Mean thickness of tunica media	Pulsatary power (Joule per heart beat)
Left caronary artery	0.32mm	200x0.32=640
Right coronary artery	0.08 mm	2000x0.08=160

Table-II

Pulse pressure, pulsatory power and volume of blood entering the lumen of coronary arteries during each heart beat in left coronary arterial dominance (LCAD) group

Arteries	Volume of blood entering the lumen during each heart beat	Pulse pressure of blood (mm of Hg)	Pulsatory power (Joule per heart beat)
Left coronary artery	10 ml	640/10=64	10x64=640
Right coronary artery	10 ml	160/10=16	10x16=160

The mean circumference of lumen of left coronary artery was equal to that of right coronary artery i.e. 10 mm which equalled with 10 ml volume of blood entering the lumen of left coronary artery as well as right coronary artery during each heart beat (Table – III)

Table-III

Lumen circumference and volume of blood entering the lumen of coronary arteries during each heart beat in left coronary arterial dominance (LCAD) group.

Arteries	Mean circumference of lumen	Volume of blood entering the lumen during each heart beat
Left caronary artery	10 mm	10 ml
Right coronary artery	10 mm	10 ml

Table-IV

Existence and deviation/alteration of "Keshaw Constants" in coronary arteries of left coronary arterial dominance (LCAD) group.

	Left coronary artery	Right coronary artery	Ratio	Keshaw Constants
Tunica media thickness	0.32mm	0.08mm	4:1	Deviating/Altering
Pulsatory power	640 Joule per heart beat	160 Joule per heart beat	4:1	Deviating/Altering
Pulse pressure of blood	64mm of Hg	16 mm of Hg	4:1	Deviating/Altering
Volume of blood entering the lumen during each heart beat	10ml	10 ml	1:1	Existing

Right Coronary Arterial Dominance (RCAD) group

Mean thickness of tunica media in 100 times magnified photomicrographs of left coronary artery was 30mm (fig-3) while the mean thickness of tunica media in 100 times magnified photomicrographs of right coronary artery was 10mm (fig-4). Therefore after dividing above mentioned mean thicknesses by 100 the actual mean thickness of tunica media in case of left coronary artery was obtained 0.3 mm while in case of right coronary artery it was obtained 0.1 mm (Table-IV) showing the ratio of 3:1 which was present not only between their pulsatory powers i.e. 600 Joule per heart beat in left coronary artery and 200 Joule per heart beat in right coronary artery (Table-V and VI) but also between their pulse pressures of blood i.e. 60mm of Hg in left coronary artery and 20mm of Hg in right coronary artery (Table-VI).

Table-V

Proportion between pulsatory power/tunica media thickness of coronary arteries in right coronary arterial dominance (RCAD) group

Arteries	Mean thickness of Tunica media	Pulsatory power (Joule per heart beat)
Left coronary artery	0.3 mm	2000 x 0.3=600
Right coronary artery	0.1 mm	2000x0.1=200

Table-VI

Pulse pressure, pulsatory power, and volume of blood entering the lumen of coronary arteries during each heart beat in right coronary arterial dominance (RCAD) group

Arteries	Volume of blood entering the lumen during each heart beat	Pulse pressure of blood (mm of Hg)	Pulsatory power (Joule per heart beat)
Left coronary artery	10ml	600/10=60	10x60=600
Right coronary artery	10 ml	200/10=20	10x20=200

The mean of circumference of lumen in left coronary was equal to that of right coronary artery i.e. 10mm which equalled with 10mm volume of blood entering the lumen of left coronary artery as well as right coronary artery during each heart beat (Table-VII)

Table-VII

Circumference of lumen and volume of blood entering the lumen of coronary arteries during each heart beat in right coronary arterial dominance (RCAD) group

Arteries	Mean circumference of lumen	Volume of blood entering the lumen during each heart beat
Left coronary artery	10mm	10 ml
Right coronary artery	10mm	10 ml

Table-VIII

Existence and deviation/alteration of "Keshaw Constants" in coronary arteries of right coronary arterial dominance (RCAD) group

	Left coronary artery	Right coronary artery	Ratio	Keshaw Constants
Thickness of Tunica media	0.3 mm	0.1 mm	3:1	Existing
Pulsatory power	600 Joule per heart beat	200 Joule per heart beat	3:1	Existing
Pulse pressure of blood	60mm of Hg	20mm of Hg	3:1	Existing
Volume of blood entering the lumen during each heart beat	10 ml	10 ml	1:1	Existing

Therefore it was observed that "Keshaw Constants" were existing in the ratio (3:1 and 1:1) in the coronary arteries of right coronary arterial dominance (RCAD) group while there was deviation/alteration of "Keshaw Constants" in the ratios (4:1 and 1:1) in coronary arteries of left coronary arterial dominance (LCAD) group which is indication of coronary heart disease according to third law of arterial blood circulation (Keshaw Kumar, 2015)[13]. In this way it is proved that deviation/alteration of "Keshaw Constants" in coronary arteries is exact cause of increased incidence of coronary heart disease in persons with left coronary arterial dominance.
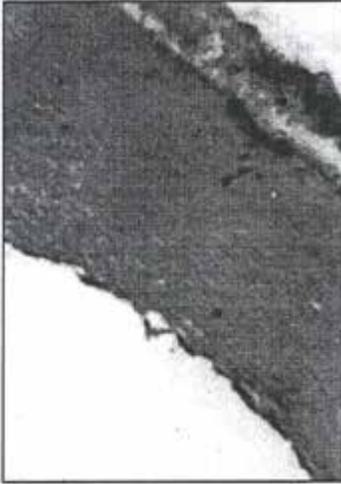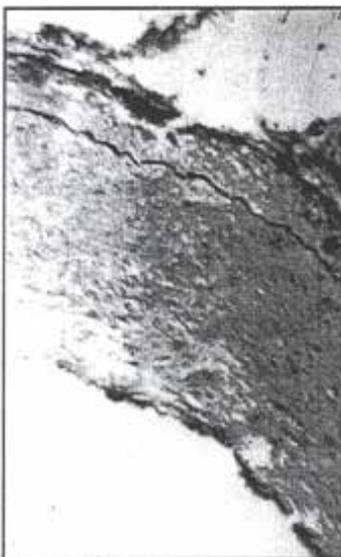
Fi-1 (Transverse section of Laft Coronary artery of human heart with Coronary artial dominance (Pas X 100)

Fi-2 (Transverse section of Laft Coronary artery of human heart with Coronary artial dominance (Pas X 100)

Fi-3 (Transverse section of Laft Coronary artery of human heart with Coronary artial dominance (Pas X 100)

Fi-4 (Transverse section of Laft Coronary artery of human heart with Coronary artial dominance (Pas X 100)

DISCUSSION

In right coronary arterial dominance during systole of heart thrice more thicker left ventricular wall (myocardium) in comparision to right ventricular wall (myocardium) is responsible for thrice more pulse pressure of blood in left coronary artery in comparison of pulse pressure of blood in right coronary artery. Thrice more wall (tunica media), thickness of left coronary artery in comparison to wall (tunica media) thickness of right coronary artery is due to thrice more pulsatory power of left coronary artery in comparison to pulsatory power of right coronary artery (Keshaw Kumar, 2003, 2007, 2015)[11,14,13].

In left coronary arterial dominance left coronary has to supply entire interventricular septum of heart instead of only its anterior 2/3 part as in right coronary arterial dominance therefore in left coronary artery pulse pressure is 64mm of Hg and pulsatory power is 640 Joule per heart beat in left coronary arterial dominance instead of 600 Joule per heart beat pulsatory power and 60mm of Hg pulse pressure of blood observed in left coronary artery in right coronary arterial dominance (Keshaw Kumar, 2008,2009, 2015)[15,12,13].

In right coronary arterial dominance right coronary artery has to supply posterior 1/3 of the interventricular septum of heart while in left coronary arterial dominance right coronary artery does not supply the interventricular septum of heart at all. This is the reason that in right coronary artery pulse pressure is 16mm of Hg and pulsatory power is 160 Joule per heart beat in left coronary arterial dominance instead of 20mm of Hg pulse pressure and 200 Joule per heart beat pulsatory power of right coronary artery observed in right coronary arterial dominance (Keshaw Kumar 2003, 2007, 2009, 2015)[11,14,12,13].

However volume of blood entering the lumen of right coronary artery and left coronary artery does not vary in right coronary arterial dominance and left coronary arterial dominance and it remains same for both the coronary arteries in both type of coronary arterial patterns i.e. 10 ml during each heart beat proving the "Keshaw Concept of Blood Volume Equality" (Keshaw Kumar, 2007, 2015)[14,13].

Therefore ratio between volumes of blood entering the lumen of left coronary artery and right coronary artery during each heart beat remains same in both type of coronary arterial patterns i.e. 1:1. In this way "Keshaw Constants" does not vary or alter and remains same in the ratio of 1:1 in both type of coronary arterial

patterns as far as volume of blood entering the lumen of both the coronary arteries is concerned.

In the present study in right coronary arterial dominance (RCAD) group ratio between pulse pressure of left and right coronary arteries resembles with the ratio between pulsatary powers of left and right coronary arteries i.e. 3:1 (Keshaw Constants) which is similar as reported by Keshaw Kumar (2003, 2007, 2009, 2015) [11,14,12,13] but in case of left coronary arterial dominance (LCAD) group the ratio between pulse pressures of left and right coronary arteries is observed 4:1 which resembles with the ratio between pulsatory powers of left and right coronary arteries which is deviation or alteration of "Keshaw Constants" being indication of coronary inefficiency or coronary heart disease as reported by Keshaw Kumar (2003,2007,2009) [11,14,12].

According to Keshaw Kumar (2009)[12] right coronary arterial dominance is a normal coronary arterial pattern because in this coronary arterial pattern there is no deviation or alteration of "Keshaw constants" (3:1 and 1:1) while left coronary arterial dominance is an abnormal coronary arterial pattern due to deviation/alteration of "Keshaw Constants" in the form of the ratios (4:1 and 1:1) in this coronary arterial pattern.

Keshaw Kumar (2008)[15] observed that right coronary arterial dominance exists in 83% population and left coronary arterial dominance exists in 16% population. Therefore 16% population of society is vulnerable for coronary heart disease. 64 mm of Hg pulse pressure of blood in left coronary artery in persons with

left coronary arterial dominance and 60 mm of Hg pulse pressure of blood in left coronary artery in persons with right coronary arterial dominance observed in the present study is the answer of as yet unanswered question that why there is increase incidence of coronary heart disease in persons with left coronary arterial dominance (Keshaw Kumar 2009)[12] because pulse pressure of blood flowing in the lumen of an artery is directly proportional to tunica intimal density of lipid in that artery (Keshaw Kumar 1996, 2003, 2015) [9,10,17].

In the past Blumgart et.al. (1940)[3], White (1951)[4], Mathur (1957)[5], Allwork (1987)[6], James (1965)[8] and Schlesinger (1940)[7] had reported increased incidence of coronary heart disease in persons with left coronary arterial dominance exact cause of which was unknown as yet. On the basis of findings observed in the present study it is being proved that deviation/alteration of "Keshaw Constants" in coronary arteries is the exact cause increased incidence of coronary heart disease in persons with left coronary arterial dominance.

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