Volume : 5 | Issue : 12 | December 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 78.46

Original Research Paper

Coronary Heart Disease in Relation With Coronary Arterial Patterns

Anatomy

KEYWORDS : Heart, Coronary artery, dominance Interventricular artery.

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ABSTRACT

Anatomy of coronary arterial patterns was studied in 288 human hearts procured from dissection room cadavers to find out relation of coronary heart disease with various coronary arterial patterns. It was observed that 83% hearts showed right coronary arterial dominance while in 16% hearts left coronary arterial dominance was present. Right coronary arterial great dominance was seen in 0.7% hearts and in 0.3% hearts coronary arterial no dominance was noticed.

Tunica intimal density of lipid in an artery is directly proportional to pulse pressure of blood in that artery (Keshaw Kumar 2003)1. Ratio of 3:1 existing between pulse pressures in left and right coronary arteries (Keshaw Kumar 2003)2 was due to ratio of 3:1 between wall thickness of left and right ventricles supplied by left and right coronary arteries respectively.

In the hearts showing right coronary arterial dominance and right coronary arterial great dominance only anterior 2/3 of interventricular septum was supplied by left coronary artery and remaining posterior 1/3 of interventricular septum was supplied by right coronary artery. In the hearts showing left coronary arterial dominance and coronary arterial no dominance the left coronary artery had to supply entire interventricular septum due to which there was further rise of pulse pressure in left coronary artery causing increased incidence of coronary heart disease.

INTRODUCTION

The cause of increased incidence of coronary artery disease in the hearts showing left coronary arterial dominance reported by Blumgart et.al. (1940)[3], White (1951)[4], Mathur (1957)[5], and Allwork (1986, 1987)[6,7] was not certain, although gross anatomy of human coronary artery was studied in the past by so many workers e.g. Grant and Regnier (1926)[8], Schlesinger (1940)[9], Ayer and Rao (1957)[10], Jain and Hazary (1958)[11], James (1965)[12], Truex (1963)[13] Ahmed et.al. (1972)[14], Omar (1977)[15], Allwork (1980, 1986, 1987)[16,17] and Keshaw Kumnar (1978, 1989, 1990, 1994, 2006)[17,18,19,20,21]. Therefore, present study regarding anatomy of coronary arterial patterns in relation with coronary heart disease was conducted to find out the cause of increased or decreased incidence of coronary heart disease in the hearts showing various types of coronary arterial patterns.

MATERIAL AND METHODS

288 human hearts procured from dissection room cadavers were preserved in 10% formalin. Coronary arteries and their branches were dissected in all the human hearts. Mean of the wall thickness of right ventricle, left ventricle, interventricular septum was obtained after measuring their wall thickness in all the hearts. Criteria for determining the type of coronary arterial dominance was based on the commencement of posterior interventricular artery (Keshaw Kumar 1978 and Allwork, S.P. 1980)[17,16]. If posterior interventricular artery commenced from right coronary artery, it was known as right coronary arterial dominance and if posterior interventricular artery commenced from left coronary artery, it was known as left coronary arterial dominance.

OBSERVATIONS

Out of 288 human hearts studied only in 45 hearts (16%) left coronary arterial dominance was observed where before crossing the crux of heart left coronary artery gave posterior interventricular artery which travelled towards the apical notch running in the posterior interventricular sulcus and supplying posterior 1/3 of interventricular septum (Fig 2) in this way in the hearts showing left coronary arterial dominance the entire interventricular septum was supplied by left coronary artery because both the anterior as well as posterior interventricular arteries were arising from left coronary artery. Anterior interventricular artery supplied anterior 2/3 of interventricular septum and posterior interventricular artery supplied posterior 1/3 of interventricular septum.

Right coronary arterial dominance was observed in 240 (83%) human hearts out of 288 hearts studied where before crossing the crux of heart right coronary artery gave posterior interventricular artery which travelled towards apical notch running in the posterior interventricular sulcus and supplying posterior 1/3 of interventricular septum (Fig. 1) while anterior 2/3 of interventricular septum was supplied by the anterior interventricular branch of left coronary artery.

Out of 288 hearts studied only 2 hearts (0.7%) showed right coronary arterial great dominance in which left coronary artery did not reach the back of heart where only right coronary artery was present travelling the entire length of coronary sulcus there (Fig. 3).

Coronary arterial no dominance was found only in I (0.3%) out of 288 hearts studied where posterior interventricular artery was absent because before reaching the crux of heart left and right coronary arteries continued as left and right posterior ventricular arteries running on both sides of posterior interventricular sulcus towards the apex of heart (Fig. 4). Thus entire interventricular septum was supplied by anterior interventricular branch of left coronary artery and posterior interventricular sulcus was devoid of any artery running into it.

In all the 288 human hearts studied the left ventricular wall was supplied by left coronary artery and right ventricular wall was supplied by right coronary artery mainly. The mean thickness of left ventricular wall as well as of interventricular septum was 6mm while the mean thickness of right ventricular wall was 2mm. Different types of coronary arterial patterns observed in the present study were as follows (Table-1)

Right coronary arterial dominance (83%).

Left coronary arterial dominance (16%)

Right coronary arterial great dominance (0.7%)

Coronary arterial no dominance (0.3%)

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Table-1
Human coronary arterial patterns and their percentage

Type of coronary arterial pattern	Number of hearts studied	Number of hearts showing dominance	Percentage
Right coronary arterial dominance	288	240	83%
Left coronary arterial dominance	288	45	16%
Right coronary arterial great dominance	288	2	0.7%
Coronary arterial no dominance	288	1	0.3%

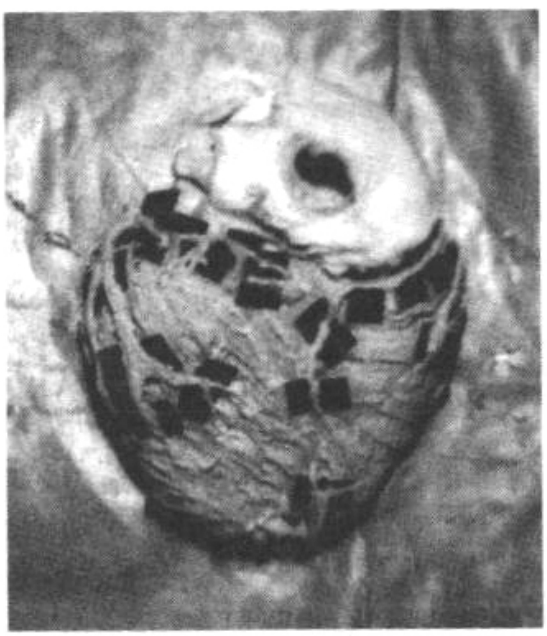

Figure - 1 Posterior view of Human Heart showing right coronary arterial dominance

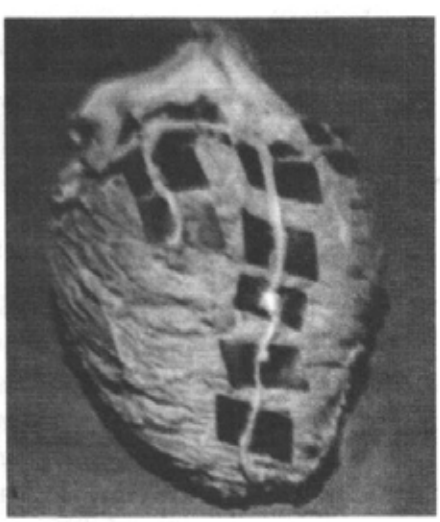

Figure - 2
(Posterior view of Human Heart showing left coronary arterial dominance)

Figure-3 Posterior view of Humen Heart showing right coronary arterial great dominance

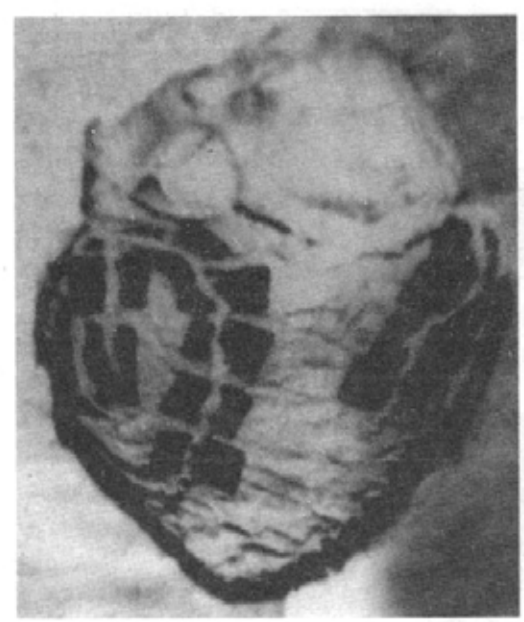

Figure - 4
(Posterior view of Human Heart showing coronary arterial no dominance)

DISCUSSION

Schlesinger (1940)[9] for the first time used the term "Dominant" in case of coronary arteries and according to him the dominant coronary artery was that which crossed the crux of heart. Keshaw Kumar (1978, 1990)[17,18] reported that coronary artery giving posterior interventricular branch not only crossed the crux of heart but also gave nodal artery to supply atrioventricular node. Allwork, S.P. (1980, 1986, 1987)[16,8,7] supported the criteria put forth by Keshaw Kumar (1978)[17] for determing the type of coronary arterial dominance and described that dominant coronary artery was that which gave posterior interventricular artery.

The concept of Omar, B.K. (1977)[15] to determine the type of coronary arterial dominance on the basis of myocardial mass supplied by right and left coronary arteries was not correct because ratio of 3:1 is existing between the wall thickness of left and right ventricles supplied by left and right coronary arteries respectively. In this ways always left coronary artery will dominate and right coronary artery will never dominate. Thus the term "dominant" used regarding coronary arteries will become irrelevant. Therefore it is proper to determine coronary arterial dominance on the basis of surface area of heart supplied by coronary artery and not on the basis of myocardial mass supplied by coronary artery. Keshaw Kumar (2015)[26] established that due to mistake "coronary arterial no dominance" type of coronary arterial pattern is being described as "codomance or balanced type of coronary arterial pattern" by the anatomists while the truth is that the codominance or balanced type of coronary arterial pattern is impossible in the nature.

In the present study the incidence of right and left coronary arterial dominance in human hearts has been observed to vary considerably from that earlier reported. The incidence of left coronary arterial dominance was 16% in the present study as compared to 10% reported by Jain and Hazary (1958)[11], 28% by ayer and Rao (1957)[10] and 18% by Schlesinger' (1940)[4]. This could be the result of racial or perhaps geographical variation. Keshaw Kumar (1989, 2015)[18,25] discovered a new coronary arterial pattern i.e. "Great dominance of right coronary artery" which is observed 0.7% in the present study resembling with findings of Keshaw Kumar (2008)[22].

The incidence of 83% right coronary arterial dominance and 16% left coronary arterial dominance obtained in the present study resemble with the findings of Keshaw Kumar (1990, 2008)[19,22] and Allwork, S.P. (1987)[7]. 0.7% incidence of right coronary arterial great dominance observed in the present study resemble with the findings of Keshaw Kumar (1989, 2006, 2008)[18,21, 22]. While 0.3% incidence of coronary arterial no dominance observed in the present study resemble with the findings of Keshaw Kumar (2008)[22].

In their study of pathological hearts Blumgart, Schlesinger and Davis (1940)[3] have correlated the incidence of coronary artery thrombosis and angina pectoris with the type of coronary arterial patterns. They concluded that in hearts showing left coronary arterial dominance the incidence of coronary artery disease was much prevalent. Similar findings have also been reported by white (1951)[4], Mathur (1957)[5] and Allwork (1986, 1987)[6,4]. Keshaw Kumar (2015)[23] established that deviation/alternation of "Keshaw Constants" in coronary arteries is the exact cause of increased incidence of coronary heart disease in persons with left coronary arterial dominance.

Ratio of 3:1 existing between pulse pressures in left and right coronary arteries (Keshaw Kumar 2003, 2009)[2,24] is due to ratio of 3:1 existing between the wall thickness of left and right ventricles supplied by left and right coronary arteries respectively as observed in the present study.

In the present study in the hearts showing left coronary arterial dominance the left coronary artery has to supply entire interventricular septum due to which there is further rise in pulse pressure in left coronary artery causing the increased incidence of coronary artery disease. In the hearts showing right coronary arterial dominance in the present study only anterior 2/3 of interventricular septum is supplied by left coronary artery and remaining posterior 1/3 of interventricular septum is supplied by right coronary artery.

Keshaw Kumar (2003, 2009)[2,24] calculated pulse pressure of blood 60mm of Hg. in left coronary artery and 20mm of Hg. in right coronary artery in the hearts showing right coronary arterial dominance while pulse pressure of blood was 64mmHg in left coronary artery and 16 mmHg in right coronary artery in the hearts showing left coronary arterial dominance [Keshaw Kumar (2009, 2015)][24,23]. Because tunica intimal density of lipid in an artery is directly proportional to pulse pressure of blood in that artery (Keshaw Kumar 2003)[1], therefore, it is established that exact cause of increased incidence of coronary arterial disease in the hearts showing left coronary arterial dominance is rise of pulse pressure of blood more than 60mm of Hg. in left coronary artery i.e. 64mmHg causing deviation/alternation of "Keshaw Constants" as reported by Keshaw Kumar (2015)[23].

On the basis of results obtained during observation the following facts are concluded as laws of coronary heart disease in relation with coronary arterial patterns.

There is increased incidence of coronary heart disease in the persons with left coronary arterial dominance and coronary arterial no dominance in comparison of persons with right coronary arterial dominance and right coronary arterial great dominance in which pulse pressure of blood in left coronary artery remains 60mmHg.

In left coronary arterial dominance and coronary arterial no dominance the left coronary artery has to supply entire interventricular septum due to which pulse pressure of blood reaches 64mm Hg. in it producing atherosclerosis.

In left or right coronary arterial dominance, posterior interventricular artery is invariably present commencing always from dominant coronary artery. Posterior interventricular artery is absent in coronary arterial no dominance. In coronary arterial great dominance only right coronary artery reaches the back of heart travelling there entire length of coronary sulcus.

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