The Dominance Pattern of Coronary Artery of Adult Bangladeshi People- A Postmortem Morphological Study

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Abstract

Key words :
Postmortem heart, Coronary arteries, Ischaemic heart disease.

Background: *Incidence of the heart disease increases day by day in Bangladesh. Recent advances in cardiac surgery and the search for new techniques toward investigation of the heart are demanding a review of the anatomy of the coronary arteries.*

Method: *The present study was performed on sixty (60) adult postmortem human hearts of Bangladeshi people. The samples were divided into 3 age groups: Group A (20 to 40 years) consists of 35 male & 7 female samples, Group B (41 to 60 years) consists of 3 female samples and Group C (61 to 75 years) consists of 7 male samples.*

Results: *In the present study, dominance pattern of the coronary artery was right for male in-group A, B, C were 32 (91.4%), 7(87.5%), 6(85.7%), respectively and for female were 6 (85.7%). 3 (100%) respectively. It was left for male in-group A, B, C were 3 (8.6%), 1 (12.5%), 1(14.3%), respectively and for female was 1 (14.3%).*

Conclusion: *The results of the present study can be helpful to the cardiologists and cardiovascular surgeons in the proper diagnosis and management of the heart diseases.*

Introduction

Bangladesh is a developing country. Bangladesh is turning rapidly towards industry based settings with her vast population and poverty stricken agro based background. As a result the life-style and food habits of the people have been changed. Most of the people are engaged in less physical activities. Rich food is taking the place of many less atherogenic food products. Various problems are also causing increasing amount of anxiety and tension among our people. Added to all these are the population booms, which means many more patients of any kind in absolute terms. Previously some communicable diseases were the principal causes of death in the poor countries like ours. With some advancement in the community health care facilities, increased awareness of the people and availability of the drugs against those diseases, other forms of diseases are taking their place. Heart disease is one of them. It is generally assumed that various sorts of problems are growing day by day which are increasing the anxiety and tension of the mankind. There have been changes in the life style of many people in these countries because of industrialization and consequent urbanization of the society[1].

It may be mentioned here that when we talk about cardiovascular diseases, the disease that comes into our mind is ischaemic heart disease (IHD) or coronary heart disease (CHD). This results sudden and unexpected fatal consequences in an otherwise healthy-looking individual. The cause of IHD is reduction in coronary blood flow due to coronary atherosclerosis in 90 percent cases. The incidence of coronary heart disease is increasing in the developing countries of South Asia and in Bangladesh. The epidemiological status of the Bangladeshi people regarding cardiovascular disorders is yet to be established. During the year 2004, 21797 patients were admitted in the National Institute of Cardiovascular Diseases (NICVD). During this period coronary angiogram was done in 4482 patients. Percutaneous coronary intervention in 599 patients and coronary artery bypass graft in 180 patients. Still, it may be assumed that many more remains improperly treated, untreated or even undiagnosed [2].

The coronary circulation consists of the blood vessels that supply blood to the heart. The coronary arteries that run on the surface of the heart are called epicardial coronary arteries. These arteries, when

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healthy, are capable of autoregulation to maintain coronary blood flow at levels appropriate to the needs of the heart muscle. These vessels are commonly affected by atherosclerosis and can become blocked, causing angina or a heart attack[3].

The exact anatomy of the myocardial blood supply varies considerably from person to person. A full anatomy of the coronary arteries requires cardiac catheterization. In general there are two main coronary arteries, the left and right. Both these arteries originate from the root of the aorta. The left coronary artery originates from the left posterior aortic sinus and the right coronary artery originates from the anterior aortic sinus[3].

Apart from the possible variations in the distribution pattern of the coronary arteries, there may be variations in the size of different coronary arteries and their branches. This may be due to racial variations in different dimensions of human heart[3]. Similar variations have been found in other organs as well. As in most cases the dimension of the coronary arteries are expected to be correlated to the heart dimension the possible racial variation in arterial size also remains a matter of interest.

Materials and Methods

The present study was performed on sixty- (60) postmortem adult human hearts of Bangladeshi people of both sexes. Among them fifty- (50) were male aged from 20 to 75 years and ten (10) were female aged from 20 to 55 years. The samples were divided into three groups (Table-1). Gross morphology of all the samples were studied by careful dissection.

The samples for the study were collected from the morgue of the Department of Forensic Medicine of Dhaka Medical College (DMC) from April 2005 to December 2005, after requisite legal formalities. The samples were collected from unclaimed dead bodies as early as possible, before any sign of putrefaction developed. The samples were washed thoroughly with tap water and gently squeezed to remove the blood clots from the cavity of the heart and from the lumen of the blood vessels as much as possible. Then the samples were brought to the Department of Anatomy of DMC- in the dissection room. By removing fat and other associated tissues samples were cleaned. Then the hearts were preserved in 10% formol saline solution.

Table-I
Age distribution in different group

Group	Age range (years)	Male	Female
A	20 to 40	35	7
B	41 to 60	8	3
C	61 to 75	7	0

The formol saline fixed samples were kept in the tap water to wash out the formol saline so as to minimize the irritation of the eyes and also for somewhat softening of the fixed tissue. Then the samples were taken in a tray and with the help of a scissors and toothed dissecting forceps, the pericardium, fat and other unwanted tissues were removed carefully so that the heart was exposed properly.

Measurement procedures:
Dominance pattern of the coronary arteries:

The posterior interventricular artery was observed (Fig. 1 & 2) whether it arose from the right coronary artery or the left coronary artery.

Statistical processing of data:
Appropriate Statistical Package for Social Science (SPSS), such as, Chi-square test, to evaluate significance of variance of the different findings were done.

Results

The present study was performed on sixty- (60) adult postmortem human hearts of Bangladeshi people, Among them fifty (50) were males aging from 20 to 75 years and ten (10) were female aged from 20 to 55 years. All the samples were divided into 3 age groups: Group A (20 to 40 years), Group B (41 to 60 years) and Group C (61 to 75 years). All the samples were studied gross morphologically.

Dominance pattern of the coronary artery:
In Group A, the right coronary artery dominance was found in 32 (91.4%) & the left coronary artery dominance in 3 (8.6%) in male and in female the right coronary artery dominance was found in 6 (85,7%) & the left coronary artery dominance in 1 (14.3%) samples. In Group B, the right coronary artery dominance was found in 7 (87.5%) & the left coronary artery dominance in 1 (12.5%) in male and in female the right coronary artery dominance was found in 3 (100%) samples. In-group C, the right coronary artery dominance was found in 6 (85.7%) & the left coronary artery dominance in 1 (14.3%) in male samples. The difference was not statistically significant (P>0.50, P>0.10), [Table 2, Fig. 1,2,3 & 4].

Table 2
Dominance pattern of coronary artery

Group	n	Right No.	Right (%)	Left No.	Left (%)	P value
Male						
A	35	32	(91.4)	3	(8.6)	
B	8	7	(87.5)	1	(12.5)	$> 0.50^{ns}$
C	7	6	(85.7)	1	(14.3)	
Female						
A	7	6	(85.7)	1	(14.3)	
B	3	3	(100.0)	0		$> 0.10^{ns}$

Statistical analysis done by Chi-square test

Group -A : Age 20-40 years

Group -B : Age 41-60 years

Group -C : Age 61-75 years

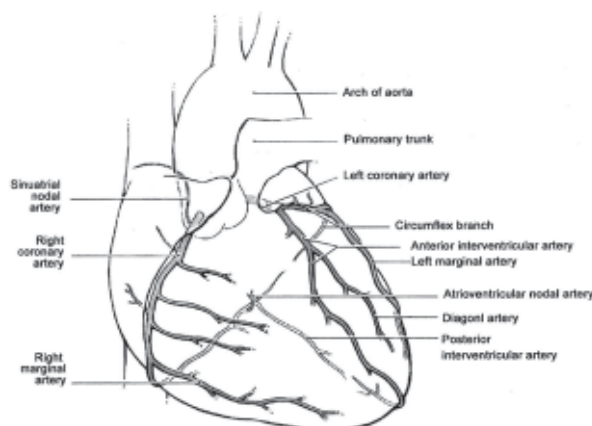M = Male   F = Female

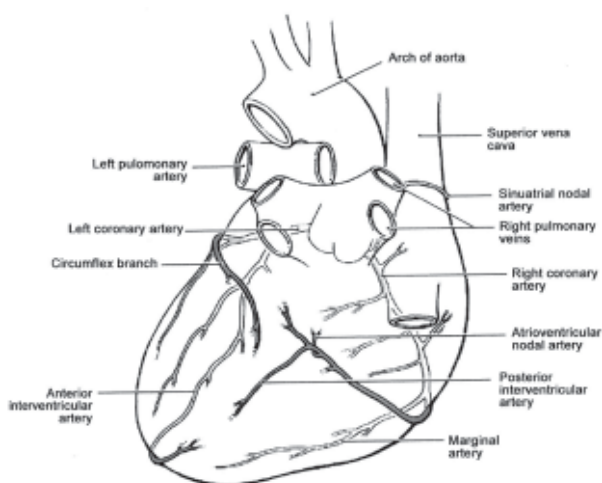ns = Not significant

Fig.-1: *Anterior view of coronary arteries*

Fig.-2: *Posterior view of coronary arteries*

Fig.-3: *Photograph showing the right coronary dominance. The diaphragmatic surface of a heart showing posterior interventricular artery arising from the right coronary artery (R=Right coronary artery, C=Circumflex artery, P-Posterior interventricular artery, →=Anastomosis between the right & left coronary arteries in the posterior interventericular groove, →→= Anastomosis between the right & left coronary arteries at the crux).*

Fig.-4: *Photograph showing the left coronary dominance. The diaphragmatic surface of a heart showing posterior interventricular artery arising from the left coronary artery (R=Right coronary artery, C=Circumflex artery, P=Posterior interventricular artery).*

Discussion

The present study was performed on sixty (60) adult postmortem human hearts of Bangladeshi people. Among them fifty (50) were males aged from 20 to 75 years and ten (10) were females aged from 20 to 55 years. All the samples were divided into 3 age groups: Group A (20 to 40 years), Group B (41 to 60 years) and Group C (61 to 75 years). Gross morphology of the samples was studied.

In the present study, right dominance for male was 32,7,6 in groups A, B, C respectively. For female, right dominance was 6 & 3 respectively. Left dominance in male was 3, 1, 1 respectively in groups A, B, C.

Sarker[1] examined 54 samples in Bangladeshi people and found right dominance in 63%, balanced 28% and left dominance in 9%. Frequency of right dominance of the present study was higher and that of left dominance was similar to the values of the study of Sarker[1]. Rahman[11] examined 70 samples and found right dominance in 70%, balanced in 17% and left dominance in 12,88% of the samples. Kalpana[10] examined 100 samples and found right dominance in 89% and left dominance in 11 % of the samples.

Williams[9] stated that the right coronary supplies the whole right ventricle (except a small region right of the anterior interventricular sulcus), a variable part of the left ventricular diaphragmatic aspect, the posteroinferior third of the intraventricular septum, the right atrium and part of the left, and the conducting system as far as the proximal parts of the right and left crura. Left coronary distribution is, of course, reciprocal, including most of the left ventricle, a narrow strip of right ventricle, the anterior two-thirds of the interventricular septum and most of the left atrium. As noted, variation chiefly affect the diaphragmatic aspect of ventricles determining the 'dominance' of coronary arteries.

In 'right dominance' the posterior interventricular artery is from the right coronary, in 'left dominance' from the left circumflex artery. In the so-called 'balanced' pattern, branches of both run in or near the sulcus. From Hutchinson's[12] study, it is apparent that in over 50% the right atrium is supplied only by the right coronary, the rest receiving a dual supply. In more than 62% of cases, left atrium is supplied by the left coronary and in about 27% by the right coronary; in 11 % cases by both coronary arteries. Sinuatrial and atrioventricular supplies also vary. According to James[14] right and left coronary arteries supply the sinuatrial node respectively in 55% and 45%, corresponding values from Baroldi and Scomazzoni's[16] study being 51 % and 41% (8% receiving bilateral supply), and from Hutchinson[12] 65% and 35%. For the atrioventricular node Jame's[14] values are 90% (right coronary) and 10% (left coronary); Hutchinson's[12] 80% and 20% respectively. Baroldi and Scomazzoni[16] noted that right coronary supplies AV node commonly and by left rarely.

Sinnatamby[2l] stated that in about 10% of hearts the right coronary is shorter than usual and the posterior interventricular artery is replaced by a continuation of the circumflex, which also supplies the AV node; in this case the heart is said to show 'left dominance'. In the more common 'right dominance', the posterior interventricular comes from the right coronary; the artery giving off the posterior interventricular branch is defined as the dominant artery.

Conclusions

A descriptive postmortem study can give an overview about the anatomy of the coronary arteries of the Bangladeshi people. However, large sample size is very important in such epidemiological studies. Routine autopsy studies of hospital deaths should be encouraged. Study on living population, including patients of heart diseases, are also important; where various types of investigations like coronary angiogram & CT angiogram may be applied. These findings may then be correlated with postmortem study results in developing a comprehensive epidemiological data pool. These data will be helpful in planning health-care delivery and research.

Due to limitation of time all age group were not covered in this study. Resin corrosive casts and angiography was not done. Further studies with large sample size covering wider age group using Resin corrosive cast and angiography is recommended.

Acknowledgements

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