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Original Research Article

A STUDY ON VARIATION IN THE TERMINATION OF RIGHT AND LEFT CORONARY ARTERIES AND THEIR CLINICAL SIGNIFICANCE

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ABSTRACT

Aim: This current study is done to throw light upon the, distribution and termination of right coronary artery and left anterior descending branch of left coronary artery and to correlate the clinical significance of the variations observed

Materials and methods: 30 human hearts from the embalmed cadavers from Department of Anatomy, Great Eastern Medical School were collected during routine dissection. The heart is taken out after incising the fibrous pericardium and great vessels .The course of right and left coronary arteries were traced from the Ostia. The specimens were duly numbered, preserved in 5% formaldehyde solution. Photographs of each specimen were taken by digital camera and the arterial pattern is coloured red digitally and labeled.

Results: In the present study the right coronary artery terminates at crux or beyond the crux in 57%, before crux in 23% and right border in 13%. Left anterior descending artery terminates beyond apex in the lower 1/3rd of the inter-ventricular groove in 87% and at the apex in 13%.

Conclusion: Right and left coronary arteries showed significant variation in their mode of termination. Better anatomical knowledge about the branches of coronary artery and its variation is essential for cardiologists and interpretation of coronary angiograms by radiologist.

KEY WORDS: Right Coronary Artery, Left Coronary Artery , Left Anterior Descending Artery, Crux Of The Heart.

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INTRODUCTION

In the human body, special circulatory organs are needed to transport and distribute the blood, ensuing that it is made accessible to all the cells in the body. These organs consist of the heart and vascular system. Heart receives its blood supply from the coronary vessels. It may seem like the heart has easy access to blood, however the blood passing through the chambers of heart does not actually supply it, instead special blood vessels, called coronary arteries deliver blood into heart muscle itself. The word coronary is derived from the Latin word co- ro-ne, Greek ko ro ne, means anything hooked or curved and coronary means 'encircling in a manner of crown' [1].

Arterial supply to heart is achieved by two arteries which are the only branches from ascending aorta. These arteries branch in such a manner that they occupy atrioventricular and Interventricular groove in the shape of a crown. Hence they are called the coronary arteries [2].

Vascular anomalies pose a great challenge to anatomists and surgeons. Holsted, a pioneer American surgeon has said that the best way to avoid injury to blood vessels is to know all possible variations in course, distribution and branches.

Knowledge of normal and variant anatomy and anomalies of coronary circulation is an increasingly vital component in the management of congenital and acquired heart diseases [3]. Variations in coronary artery anatomy are often recognized in association with structural forms of congenital heart disease. Importantly, coronary artery anomalies are a cause of sudden death in young athletes in the absence of additional heart abnormalities [4].

The coronary artery study in regard to the area of distribution is a matter of prime medical importance. Their physiological significance is indicated by the fact that they utilize 10% of the blood flowing through the aorta [5].

The coronary arteries once thought of as end arteries are now known to anastomose with each other in nearly all areas of the heart. In some areas such as the atrial and ventricular septa, the apex, the crux and the anterior surface of the right ventricle, where the anastomosis is rich, there is considerable potential for the development of collateral circulation [6].

Right coronary artery (a. coronaria dextra) [7] arises from the anterior (right coronary) aortic sinus, It passes at first anteriorly and slightly to the right between the right auricle and pulmonary trunk, It reaches the AV groove and descends in this almost vertically to the right (acute) cardiac border, curving around it into the posterior part of the groove, where the latter approaches its junction with both interatrial and interventricular groove, a region appropriately termed crux of the heart. The artery reaches the crux and ends a little to the left of it, often by anatomizing with the circumflex branch of left coronary artery

Left coronary artery (a. coronaria sinistra) [7] arises from the left posterior (left coronary) aortic sinus, lies between the pulmonary trunk and left atrial auricle, emerges into the AV groove, in which it turns left & divides into its two main branches.

1) Anterior interventricular (descending) artery

2) Circumflex artery

The anterior descending artery: is commonly described as its continuation. This artery descends obliquely forward and to the left in the interventricular groove. It reaches the apex and terminates there or more often it turns round the apex into the posterior interventricular groove, and passes 1/3rd to 1/2 way along its length, and meets with terminal twigs of the posterior interventricular branch of the right coronary artery.

The circumflex artery: comparable to the anterior interventricular in caliber, curves left in the atrioventricular groove, continuing around the left cardiac border into the posterior part of the groove and ending left of the crux in most hearts.

This current study is done to throw light upon termination of right coronary artery and left anterior descending branch of left coronary artery and correlate the significance clinically.

MATERIALS AND METHODS

30 human hearts from the embalmed cadavers from Department of Anatomy, Great Eastern Medical School. were collected during routine dissection and preserved in 5% Formalin solution

The heart is taken out after incising the fibrous pericardium and great vessels like aorta, pulmonary trunk, superior venacava, inferior vena cava and pulmonary veins. The courses of right and left coronary artery were traced from the Ostia by cleaning the epicardium and fat by dissection. The dissection was done under water. The coronary veins were removed to avoid confusion. The specimens were duly numbered, preserved in 5% formaldehyde solution. Photographs of each specimen were taken by digital camera and the arterial pattern is coloured red digitally and labeled.

RESULTS

Observation on the level of termination of right coronary artery revealed that it terminated at crux or beyond crux in 17 out of 30 (57%) specimens, before crux in 7 (23%) specimens, at right border of heart in 4 (13%) specimens

and before right border in 2 (7%) specimens. (table 1) (graph 1)

Observation on the level of termination of LAD branch of left coronary artery revealed that it terminated beyond apex in the lower part of the posterior IV groove in 26 out of 30 specimens (87%), and at the apex in 4 out of 30 specimens (13%). (table 2) (graph 2)

Table 1: Level of termination of right coronary.

	No. of specimens	Percentage
Before right border	2	7%
At right border	4	13%
Before crux	7	23%
At crux or beyond crux	17	57%

Graph 1: Level of termination of right coronary artery.

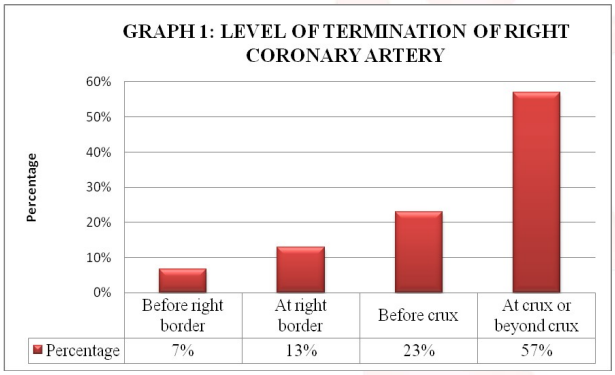

Table 2: Level of termination of left anterior descending artery.

Level of termination of LAD artery	No. of specimens	Percentage
At apex	4	13%
Lower 1/3rd of Posterior interventricular groove	26	87%

Graph 2: Level of termination of LAD.

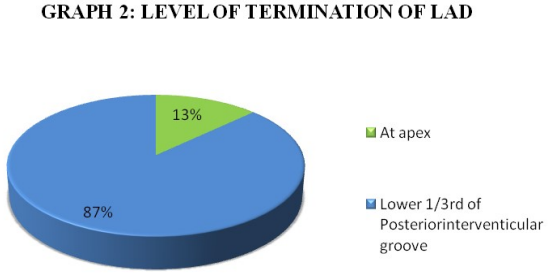

Table 3: Level of termination of right coronary artery

S.No	Study done by	At the right border (%)	Before the crux (%)	At the crux or beyond crux (%)
1	Grays [8]	10	20	60
2	Kalpana R (2003) [3]	7	6	76
3	Present Study	13	23	57

Table 4: Level of termination of left anterior descending.

S.No	Study done by	Before apex (%)	At apex (%)	Lower 1/3 rd posterior interventricular groove (%)
1	James (1961) [9]	17	23	60
2	Kalpana R (2003) [3]	8	12	80
3	Present Study (2011)	0	13	87

DISCUSSION

The branching pattern and distribution of coronary arteries have been studied by various workers in the past. The present study was taken up with the hope that the data collected in the study may help clinician to interpret properly the findings which will lead on to its remedy.

In the present study RCA terminated at crux or beyond crux in 57%, before crux in 23% and right border in 13%. In three specimens it terminated before right border.

The right coronary artery terminated at 1 to 3 cms beyond crux in 76%, reached up to the left border in 8%, terminated at the crux in 6%, at right margin in 7% and between right margin and crux in 3% of the specimens[3]. The findings of the present study regarding the termination of right coronary artery are closer to those in the Grays Anatomy [8] (table 3)

A detail normal study of coronary arteries has been done by James in 1961 [9]. He has explained the coronary arteries and its branches in detail and done a casts of coronary arteries and described about the anastomosis of right and left coronary arteries at the epicardial level. James (1978) considers the evidence conclusions for anastomoses at all levels. Subepicardial, myocardial and subepicardial the most frequent sites of extramural anastomoses are the apex, the anterior aspect of right ventricle, posterior aspect of left ventricle, crux inter atrial and interventricular sulci and between sinoatrial nodal and other atrial vessels. The functional value of such anastomoses must vary but they appear to become more effective in slowly progressive pathological conditions. Extra cardiac anastomoses may connect various coronary branches with other thoracic vessels via the pericardial arteries and arterial vasa vasorum of vessels linking the heart with systemic and pulmonary circulation.

By definition, the term anomalous or abnormal

is used to define any variant form observed in less than 1% of the general population. The RCA terminates at 1-3 cms beyond crux in 76%, reached up to the left border in 8%, and terminates at crux in 6%, at right margin in 7% and between right margin and crux in 3% of specimens [3]. The main trunk of LCA bifurcated in 47%, trifurcated in 40% and quadrificated in 11% of specimens [3] (table 3).

The right coronary artery ends near the right cardiac border (10%), or between this and crux (10%); more often (20%) it reaches the left border, replacing part of the circumflex artery [8] (table 3).

In the present study the LAD terminated beyond apex in the lower part of the posterior IV groove in 87% and at the apex in 13% closely resembling the findings those of Kalpana R [3] where the LAD branch crossed over the apex to reach up to 2-5 cms up to the posterior IV groove in 80%, up to the anterior apex in 8% and posterior apex in 12% of the specimens [3] (table 4).

CONCLUSION

The present study on distribution and termination of coronary arteries shows some difference with respect to the results from the available literature.

The level of termination of right coronary artery showed that 57% terminated at crux or beyond. The level of termination indicates that right coronary artery supplies major part of right atrium, right ventricle and the length of right coronary artery in the atrio ventricular groove beyond the crux will show the blood supply to the left ventricle adjacent to the posterior inter ventricular groove, the posterior 1/3rd of the interventricular septum hence the conducting system, the Sinoatrial node, atrioventricular node and atrioventricular bundle including right bundle of His is supplied by right coronary artery in mainly right dominant heart. Whereas in the left dominance except for the Sinoatrial node the rest of the conducting system of heart is supplied by left coronary artery.

The termination of left anterior descending branch varies and accordingly the blood supply to the anterior 2/3rd of the interventricular septum is supplied by left coronary artery.

Better anatomical knowledge about the branches of coronary artery and its variation is essential for cardiologists and interpretation of coronary angiograms by radiologist.

ABBREVIATIONS

RCA- Right Coronary Artery

LAD- Left Anterior Descending

LCA- Left coronary Artery

Conflicts of Interests: None

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