



## STUDY OF THE BRANCHING PATTERN OF THE LEFT CORONARY ARTERY IN CADAVERIC HEARTS

### Anatomy

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### ABSTRACT

**BACKGROUND-** Coronary artery disease is one of the major causes of the death worldwide. The left coronary artery supplies major part of the left ventricle and as the diseases of the left coronary artery is more , in depth study of the course , branching pattern and variations of the left coronary artery is essential for medical and therapeutic interventions. **AIM-**To study the branching pattern of the left coronary artery. **MATERIAL AND METHODS:** The present study was conducted in 40 adult hearts specimens irrespective of sex , with no obvious pathology that were used during the routine academic dissection for M.B.B.S students in the Department of Anatomy ,JMCH and also from the autopsies done in the Department of Forensic Medicine & Toxicology ,JMCH ,Assam. The hearts were preserved in 10% formalin and dissected in a convenient time later. After removal of the visceral pericardium and sub epicardial fats , coronary arteries were identified alongwith their branches and traced till their termination . The arteries were painted with red fabric colour to enhance the contrast. Photographs were taken and the relevant data were recorded and analyzed statistically. **RESULTS:** The origin of the left coronary artery and its branching pattern was studied . In all the specimens the origin of left coronary artery was from left posterior aortic sinus. Out of 40 adult hearts bifurcation was found in 28 specimens (70%) and trifurcation in 12 specimens(30%). **CONCLUSION:** Knowledge of the variations of the branching pattern of the left coronary artery is useful for the cardiac surgeons for interpretation of arterial occlusions and for performing interventional life saving procedures.

### KEYWORDS

Coronary artery disease, coronary artery, trifurcation , aortic sinus.

### INTRODUCTION

The heart is a vital organ that pumps blood for the tissues in human body. It has its own unique arterial supply provided by the coronary arteries<sup>2</sup> . Anatomies of the coronary arteries have been widely established due to its clinical importance. The heart is supplied mostly by the two coronary arteries. Anatomically the coronary arteries are not end arteries because they anastomose with each other by their trunks , branches and the sub branches mostly at the precapillary level. Functionally they behave like end arteries because of the anastomose remains impervious.<sup>3</sup>

The two coronary arteries right coronary artery (RCA) and the left coronary artery (LCA) arise from the aortic sinus of valsalva at the root of the aorta and encircle the base of the ventricles like a crown<sup>1</sup> . The LCA arises from the left posterior aortic sinus. It is responsible for irrigation of most of the left ventricle and also a considerable portion of the right ventricle. On reaching the coronary sulcus the LCA divides into two main branches the anterior inter-ventricular artery and the circumflex artery<sup>7</sup>. The anterior inter-ventricular branch of the LCA runs towards the apex and gives off a diagonal branch. The circumflex branch of the LCA gives off a left marginal branch and then terminates on the posterior aspect reaching the crux<sup>2</sup>.

The term "anomaly" is used for variations that occur in less than 1% of the general population<sup>5</sup>. Thus this study is aimed to determine these variations in the LCA and its branches. The study of the coronary arteries will be useful to the cardiologists and radiologists to predefine abnormalities by invasive and non invasive studies .Hence increasing use of diagnostic and therapeutic interventional procedures requires a sound , basic knowledge of the coronary artery pattern.

### AIMS AND OBJECTIVES

- To study the branching pattern of the left coronary artery.

### MATERIALS AND METHODS

After obtaining ethical clearance from the Institutional Ethical Committee , the present study was conducted in the Department of Anatomy, Jorhat Medical college and Hospital over a period of 1and half year . About 40 adult human hearts were dissected and studied. The specimens of heart were collected from the cadavers officially received in the Department of Anatomy and also from the autopsies done in the Department of Forensic Medicine & Toxicology .

The heart specimens were preserved in 10% formalin solution. They were tagged numerically .The visceral pericardium was stripped off

and fat was removed from the coronary sulcus. The left coronary artery was traced from its origin till its termination. All the branches were dissected and variations were recorded and photographed. Statistical analysis was done.

### Inclusion criteria

Normal adult heart

### Exclusion criteria

Lacerated, grossly mutilated and decomposed hearts were excluded..

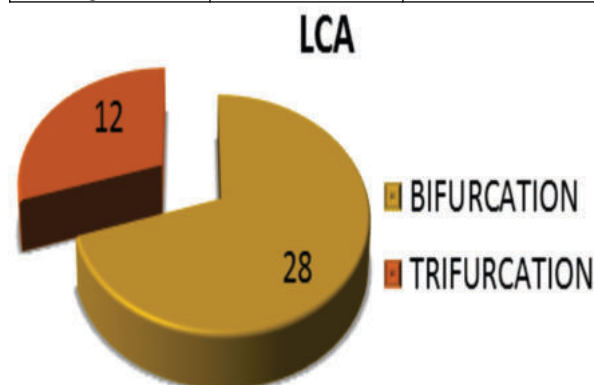
### RESULTS AND OBSERVATIONS

In this study the left coronary artery have its origin from the left posterior aortic sinus. Out of the 40 adult hearts bifurcation of the left coronary artery was found in 28 specimens and trifurcation in 12 specimens.

In bifurcation ( Figure 2) the left coronary artery gave the anterior interventricular ( AIC) and the circumflex coronary arteries(CA). In Trifurcation (Figure3) the LCA gave the AIC, CA and an additional branch , the diagonal artery (DA).

**Table-1: Branching Pattern Of The Left Coronary Artery**

| No. Of Specimen | Bifurcation | Trifurcation |
|-----------------|-------------|--------------|
| 40              | 28          | 12           |
| Percentage      | 70          | 30           |

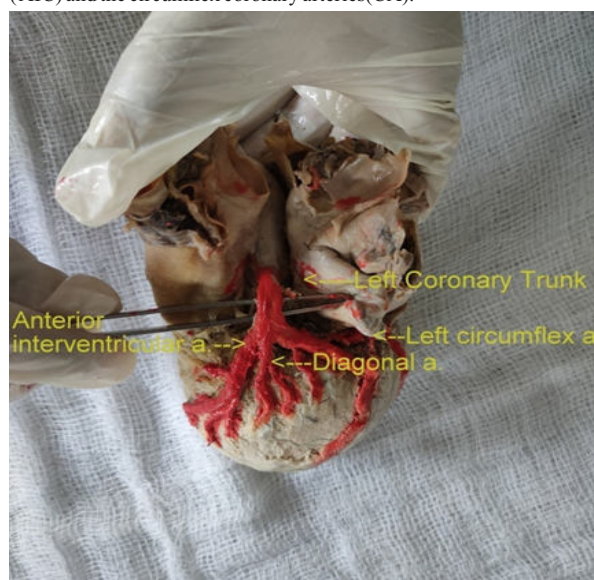


**Fig. 1: Showing The Branching Pattern Of The Lca**



**Fig. 2-** Bifurcation Of The Lca

In bifurcation the left coronary artery gave the anterior interventricular (AIC) and the circumflex coronary arteries (CA).



**Fig. 3** – Trifurcation Of The Lca

In Trifurcation the LCA gave the AIC, CA and an additional branch, the diagonal artery (DA).

## DISCUSSION

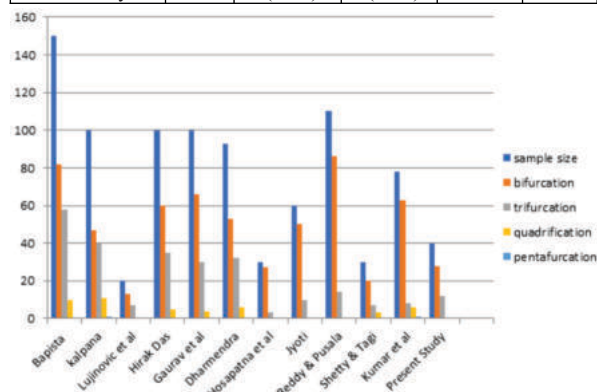
During the third week of intrauterine life the first evidence of development of the coronary vessel begins. The stages involved in the development of coronary arteries are vasculogenesis, angiogenesis, arteriogenesis and remodeling. Due to this complexity in the development of coronary arteries, anomalies and variations are common<sup>6</sup>. The left coronary artery usually terminates by dividing into 2 branches: the anterior interventricular artery and the circumflex artery<sup>7</sup>. Sometimes it may terminate by dividing into 3 or rarely 4 branches. The third and the fourth branches of the left coronary artery supply the anterior wall of the left ventricle. If the left coronary artery terminates by dividing into 2, the same region is supplied by branches from the anterior interventricular and circumflex branches<sup>8</sup>. Results of the present study are consistent with earlier reports that 40-70% of LCA bifurcates (Lujinovic and Ovcina, 2009; Reig and Petit, 2004; Gaurav, 2013). Trifurcation is less common. The wide range in frequency of trifurcated division can be explained by the different

approaches used for defining the diagonal branch. According to Braunwald the diagonal arteries are originated from the anterior interventricular branch and supplied the anterior wall of the left ventricle. Baptista et al in his study, indicated that the third branch of the left coronary artery should be named as coronary artery. Anderson and Becker named the third branch originating from the main trunk of the coronary artery and coursing on the anterior surface of the left ventricle as the intermediate artery. The branches that originate from the anterior inter-ventricular artery and coming to the anterior surface of the left ventricle were defined as the diagonal artery<sup>12</sup>. Diagonal branch originates in the vertex of the angle formed by the terminal branches of the left coronary artery or in the initial millimeters of the anterior interventricular artery and the circumflex branch.<sup>9</sup>

The first of atherosclerosis states that it is prone at branching points<sup>10</sup>. Trifurcation has a protective role against myocardial ischaemia but it may cause technical difficulties during catheterisation and a source of complication.<sup>11</sup>

## Results Of The Present Study Are Consistent With The Earlier Reports Shown In The Table Below.

| Author                        | Sample Size | Bifurcation | Trifurcation | Quadrifurcation | Pentafurcation |
|-------------------------------|-------------|-------------|--------------|-----------------|----------------|
| Bapista <sup>7</sup>          | 150         | 82(54.7 %)  | 58(38.7%)    | 10(6.7%)        | NIL            |
| kalpana <sup>14</sup>         | 100         | 47(47 %)    | 40(40%)      | 11(11%)         | 1(1%)          |
| Lujinovic et al <sup>13</sup> | 20          | 13(65%)     | 7(35 %)      | NIL             | NIL            |
| Gaurav et al <sup>9</sup>     | 100         | 66(66%)     | 30(30 %)     | 4(4%)           | NIL            |
| Hirak Das <sup>15</sup>       | 100         | 60(60%)     | 35(35%)      | 5(5%)           | NIL            |
| Dharmendra <sup>16</sup>      | 93          | 54(58%)     | 33(35.4%)    | 6(6.4%)         | NIL            |
| Hosapatna et al <sup>17</sup> | 30          | 28(93.3%)   | 2(6.7%)      | NIL             | NIL            |
| Jyoti <sup>18</sup>           | 60          | 50(83.3%)   | 10(16.6%)    | NIL             | NIL            |
| Reddy & Pusala <sup>20</sup>  | 110         | 95(86%)     | 15(14%)      | NIL             | NIL            |
| Shetty & Tagi <sup>19</sup>   | 30          | 20(66.6%)   | 7(23.3%)     | 3(10%)          | NIL            |
| Kumar et al <sup>1</sup>      | 78          | 63(80.7%)   | 8(10.2%)     | 7(7.69%)        | (1.28%)        |
| Present study                 | 40          | 28 (70%)    | 12(30%)      | NIL             | NIL            |



## SUMMARY AND CONCLUSION

Knowledge of the normal and variant anatomy of coronary arteries is indispensable and imperative both in diagnosis, treatment and implementation of interventional measures. Studying the variations of the coronary artery is also helpful to avoid the misinterpretations and complications during the above procedures. It is also mandatory for the anatomists to update the knowledge of the gross anatomy of coronary arteries to their students.

## Conflict Of Interest

Nil

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Self

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