AN ANATOMICAL STUDY OF CORONARY ARTERY DOMINANCE IN HUMAN CADAVERIC HEARTS
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BACKGROUND
Coronary arteries supply oxygen rich blood to entire heart muscle. They divide and their branches encircle the heart to cover its surface with a lacy network resembling a crown. The artery supplying the Posterior Descending artery (PDA) determines the coronary dominance. A right dominant coronary circulation is one in which the PDA is a terminal branch of Right Coronary Artery (RCA) and in left dominance, PDA arises from left coronary artery. Left dominant hearts are at an increased risk of coronary heart diseases. Therefore, the present study aims at studying the coronary dominance in hearts obtained from adult and perinatal cadavers.

MATERIALS AND METHODS
50 human cadaveric hearts were collected and meticulously dissected. All the results were noted and photographs taken. This study was carried out in the Department of Anatomy of Tezpur Medical College, Sonitpur, Assam, on 50 heart specimens. Out of 50 hearts, 20 hearts were from perinatal cadavers that is between 28th weeks of gestation to 7 days after birth and the remaining 30 hearts were from adult cadavers. Out of the total hearts, 31 hearts were male and 19 hearts were female. The perinatal heart specimens were collected from the Department of Obstetrics and Gynaecology. The adult hearts were collected from the cadavers received in the Department of Anatomy and also from the unclaimed bodies received in the Department of Forensic Medicine, Tezpur Medical College and Hospital.

RESULTS
Right dominance was noted in 76% of hearts, left dominance was noted in 20% hearts and 4% of hearts revealed balanced dominance. Right dominance was found more common than left dominance in both male and female. Percentage of left dominance was noted more in males than females. The results of the present study were compared with similar previous studies and discussed.

CONCLUSIONS
The knowledge of right or left coronary dominance is important from the point of view that left coronary artery dominant people are more susceptible for coronary heart disease. Therefore, preoperative information about coronary arterial anatomy and dominance will be helpful for the cardiothoracic surgeons in planning necessary surgical techniques to reduce coronary diseases.

KEYWORDS
Coronary Artery, Right Dominance, Left Dominance, Codominance.

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BACKGROUND
Cardiovascular Diseases (CVD) cause nearly 1/3 of all death worldwide. Coronary Heart Disease (CHD) accounts for the greatest proportion of CVD.1 The prevalence of Coronary Artery Disease (CAD) in India has rapidly increased from 1% in 1960 to 9.7% in 1995.2 M.N. Krishnan (2012) stated in his study that the Global Burden of Diseases Study reported that the disability adjusted life years lost by CHD in India during 1990 was 5.6 million in men and 4.5 million in women. The projected figures for 2020 were 14.4 million and 7.7 million in men and women, respectively.3 Dorairaj Prabhakaran (2016) stated that the Global Burden of Disease Study estimate of age standardised CVD death rate of 272 per 1,00,000 population in India is higher than the global average of 235 per 1,00,000 population. Premature mortality in terms of years of life lost because of CVD in India increased by 59% from 23.2 million (1990) to 37 million (2010).4 Rajeev Gupta (2016) have mentioned in his study that the Registrar General of India reported that CHD led to 17% of total deaths and 26% adult deaths in 2001-2003, which increased to 23% of total and 32% of adult deaths in 2010-2013.5

The term coronary comes from Latin word “corona” meaning crown.6 The heart is supplied by two coronary arteries - right and left arising from the anterior and the left posterior aortic sinuses, respectively. Each coronary artery
is a vasa vorum of the ascending aorta, because the heart is developed from fusion of two primitive endothelial tubes, which represent the ventral aortae. Functionally, the coronary arteries behave like end arteries, though anatomically they are not as most of the anastomoses remain impervious.\(^7\)

The coronary circulation was first described by Banchi in 1904.\(^8\) Later on, Hettler provided very detailed criteria for the type classification based on the course of the anterior and posterior interventricular branches and defined the following types left coronary artery dominance, right coronary artery dominance and codominant or balanced.\(^8\)

The term ”dominant” is used to refer to the coronary artery giving off the posterior interventricular (descending) artery, which supplies the posterior part of the ventricular septum and often part of the posterolateral wall of the left ventricle. In right dominance, the Posterior Interventricular Artery (PIV) is derived from the right coronary artery. In left dominance, it is derived from the left coronary artery. In balanced dominance, branches of both the arteries run in or near the posterior interventricular groove.\(^9\) According to Keith L. Moore (2009), variations in the branching patterns and distribution of the coronary arteries are common. Right dominance pattern is present in approximately 67% of people. In approximately 15% of hearts, left coronary artery is dominant. There is codominance in approximately 18% of people.\(^10\)

A. K. Dutta (2008) stated that in 70% of the population, the posterior interventricular artery originates from the right coronary artery and in 10% individuals, the PIV is derived as a continuation of left coronary artery and on rare occasions, it is derived from both coronary arteries.\(^7\)

Left dominant people are likely to be affected by coronary diseases, because the entire left ventricle and the ventricular septum are under the nutritional control of left coronary artery and its obstruction may produce output failure of systemic circulation.\(^7\)

In a study conducted by A. Goldberg (2007), it was noted that in patients with acute coronary syndrome, left dominance is a significant and independent predictor of increased long-term mortality.\(^11\) S Eren et al (2008) in their study detected that right dominance is more common in general population and both coronary diseases and coronary artery variations are more common in individuals with left dominance.\(^12\) Nisha I. Parikh (2012) stated that left and codominance are associated with modestly increased post percutaneous coronary intervention in-hospital mortality in patients with acute coronary syndrome.\(^13\)

Ronald A. Bergman (2015) had stated that left dominance is 8 times more frequent in males (18.2%) than females (2.6%).\(^14\) In another study conducted by Kaimkhani et al (2005), 78.7% males and 21.2% females had left dominance.\(^15\) James (1961) noted left coronary artery predominance in males.\(^16\) Therefore, a precise knowledge and better understanding of coronary arterial anatomy and dominance is mandatory especially for the angiographers and cardiothoracic surgeons for an efficient management of Coronary Artery Disease (CAD) and accompanying complications like myocardial ischaemia and sudden cardiac death.

**AIMS**

1. To study the pattern of coronary artery dominance in cadaveric human hearts.
2. To study the presence of any sex difference in the dominance pattern.

**MATERIALS AND METHODS**

This study was carried out in the Department of Anatomy of Tezpur Medical College, Sonitpur, Assam, on 50 heart specimen. Out of 50 hearts, 20 hearts were from perinatal cadavers that is between 28\(^{th}\) weeks of gestation to 7 days after birth and the remaining 30 hearts were from adult cadavers. Out of the total hearts, 31 hearts were male and 19 hearts were female. The perinatal heart specimen were collected from the Department of Obstetrics and Gynaecology. The adult hearts were collected from the cadavers received in the Department of Anatomy and also from the unclaimed bodies received in the Department of Forensic Medicine, Tezpur Medical College and Hospital.

**Inclusion Criteria**

All the heart specimens were randomly selected. Normal hearts with no obvious gross anomalies were considered for the study.

**Exclusion Criteria**

The cadaveric hearts with lesions because of accidents/trauma and those hearts having gross congenital anomalies were excluded from this study. After fulfilment of all official formalities, the cadavers were received in the Department of Anatomy and the particulars of the cadavers (age, sex and cause of death) were noted. The hearts were removed from the middle mediastinum and preserved in 10% formalin (formalin = 40% solution of formaldehyde in water. 10% formalin = 10 parts formalin + 90 parts water). The hearts were dissected at a convenient time later. The coronary arteries were exposed after clearing the epicardium and fat. The arteries were traced and painted with red colour for proper identification. Photographs were taken and results were noted. The study results were compared with other similar studies of previous authors.

**RESULTS**

<table>
<thead>
<tr>
<th>Dominance Pattern</th>
<th>Perinatal</th>
<th>Adult</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>15</td>
<td>23</td>
<td>38</td>
<td>76%</td>
</tr>
<tr>
<td>Left</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>20%</td>
</tr>
<tr>
<td>Co</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4%</td>
</tr>
</tbody>
</table>

*Table 1. Showing the Percentage of Dominance Pattern*
**DISCUSSION**

<table>
<thead>
<tr>
<th>Authors (Year)</th>
<th>Right Dominance</th>
<th>Left Dominance</th>
<th>Codominance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present study</td>
<td>76%</td>
<td>20%</td>
<td>4%</td>
</tr>
<tr>
<td>Decio (2009)</td>
<td>72%</td>
<td>20%</td>
<td>8%</td>
</tr>
<tr>
<td>Das H et al (2010)</td>
<td>70%</td>
<td>13%</td>
<td>8%</td>
</tr>
<tr>
<td>Michele (2011)</td>
<td>70%</td>
<td>10%</td>
<td>20%</td>
</tr>
<tr>
<td>Vasudeva (2013)</td>
<td>86.25%</td>
<td>11.26%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Kam et al (2015)</td>
<td>77.6%</td>
<td>9.8%</td>
<td>12.5%</td>
</tr>
<tr>
<td>Usha K et al (2014)</td>
<td>86.6%</td>
<td>6.66%</td>
<td>6.66%</td>
</tr>
<tr>
<td>Gohain N et al (2015)</td>
<td>64.44%</td>
<td>24.45%</td>
<td>11.11%</td>
</tr>
</tbody>
</table>

The results of the present study were compared with similar previous studies (Table 3). Regarding the percentage of right dominance, the results of the present study were similar with Decio (2009), Das H (2010), Michele (2011) and Kam (2015). Considering the left dominance pattern, this study complies with Decio (2009) and Madhushree P (2016) and lastly 4% codominance was recorded in the present study, which does not coincide with the previous findings.

The previous studies show that right dominance is more common than left, which is in concurrence with the results of the present study.

The present study shows that percentage of left dominance is more in males (22.58%) than females (15.70%), which complies with Z. A. Kaimkhani (2005), Ronald A. Bergman (2015) and James (1961) who also noted a male preponderance of left dominance.

**CONCLUSION**

In the present study, out of 50 hearts, 38 hearts (76%) showed right dominance. Left dominance was noted in 10 hearts (20%). Remaining 2 hearts (4%) showed codominance.

The study also shows a sex difference in the dominance pattern. Left dominance was more common in males (22.58%) than females (15.70%). Right dominance was more common than left dominance in both the male (70.96%) and female (84.2%).

To conclude, coronary arterial anatomy and dominance pattern have a lot of variations as seen in the present study and previous literature reviews. Coronary dominance pattern has a significant role to play in deciding the final outcome and prognosis of coronary artery diseases. Therefore, it was a humble and honest attempt to study the same, which might help cardiac physicians and surgeons in planning treatment and interventions to help the cardiac patients.
**Figure 3. Anterior View of Heart**

A- Right Coronary, B- Circumflex Artery, C- Anterior Interventricular Artery.

**Figure 4. Right Dominance**

A- Left Marginal, B- Posterior Interventricular, C- Right Coronary, D- Anterior Interventricular.

**Figure 5. Left Dominance**

A- Circumflex Artery, B- Posterior Interventricular Artery.

**Figure 6. Codominance**

A- Circumflex Artery, B- Posterior Interventricular Artery, C- Right Coronary, D- Ventricular Rami from Right Coronary Artery.

**REFERENCES**


