

Gender Difference in the Left Coronary Artery: An Angiographic Study.

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Abstract

Introduction: The prevalence of coronary artery disease in India has led to a rapid transition in health status. Knowledge of coronary artery anatomy including anomalies and variations according to region is very important for clinical therapeutic surgeries. The heart was supplied by two coronary arteries i.e. right and left coronary arteries respectively. Out of two arteries, Left Coronary Artery (LCA) irrigates most of the area of the heart and presents wide variability in its morphology. **Subjects and Methods:** The present study was carried out in two hundred fifty healthy individuals out of whom one hundred twenty were male. **Results:** According to division of Left Coronary artery, Bifurcation was seen in 107 males and 111 females. Trifurcation of left coronary artery was seen in seventeen males and twelve females and quadrifurcation was seen in one male and two females. Length of left coronary artery was significantly high in females and diameter was more in males. **Conclusion:** The findings in this study can help to understand the significant association between the length and angle of division of left coronary artery. The knowledge about anatomy and variations of left coronary artery is very useful for cardiologists to treat clinical complications.

Keywords: Division of Left Coronary Artery, myocardial infarction, coronary artery disease.

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Introduction

The rise in coronary heart disease in India has led to a rapid transition in health status. Prevalence of coronary artery disease is around 3 - 4% in rural areas and 8 - 10% in urban areas among adults older than 20 years.^[1] "Anomaly is referred as the variation that occurs in less than 1% of the general population".^[2]

Knowledge of coronary artery anatomy, its variations and anomalies related to coronary circulation is very essential for good clinical outcome following therapeutic procedures, like coronary bypass grafting, angioplasty etc.

The heart is supplied by the two coronary arteries and their branches. The right and left coronary arteries (RCA and LCA) originate at the base of the ascending aorta, within the aortic sinus, as the first branches of this vessel. Blood pressure here is the highest found anywhere in the systemic circulation. This pressure ensures continuous flow of blood to meet the demand of cardiac muscle tissue. Variations occasionally occur in their origin and branching patterns. Each coronary artery is the primary source of supply to its same side atrium and ventricle, but also supply opposite side chambers to some extent.^[3]

The LCA supplies most of the area of the heart. The area irrigated by each of coronary arteries using postmortem angiography shows that the LCA irrigates 68.8% of the cardiac muscular tissue (41.5% by Left Anterior Descending and 27.3% by the Circumflex artery).^[4] These values varies depending upon the dominant pattern.

The LCA presents wide variability in its morphology (length and calibre) and the number of branches from its trunk. The knowledge of such variations is essential in determining areas related to arterial occlusive disease, hemodynamic procedures, handling heart surgery and finally in terms of educational value.

The length of the LCA extends from the origin at aortic sinus to its division as its terminal branches. The course of the LCA is rarely longer than two centimetres in adults. Then it divides into the circumflex (Cx) and anterior interventricular artery (AIA) branches.^[5] Now a days it became very useful to explore the LCA anatomy and its variations because there is extensive use of radiographic images for interventional and diagnostic purposes.^[6,7] Further, it is also useful in the development of surgical, non-invasive treatment of Coronary Artery Disease (CAD).^[8]

Since decades the anatomy of coronary arteries has been

studied in various populations by cadaveric dissection, but we have very little information in angiographic studies of coronary arteries. So this study was conducted to assess the gender differences in relation to LCA in Indian healthy population by coronary angiography.

Subjects and Methods

This study was executed after getting ethics committee clearance from Rohilkhand Medical College and Hospital, Bareilly and Santosh University, Ghaziabad. Coronary angiogram was performed to study the morphology of coronary arteries.

Out of two hundred and fifty healthy individuals, one hundred and twenty-five were males. Age of study participants was 29.53 ± 5.13 years. We have excluded if they have any underlying pathological conditions.

The LCA length was taken in each of the angiograms from its orifice (visualized by spillback of contrast medium into the aorta during selective injection) to its point of division into its terminal branches. Measurements were taken in a single frame projection which shows the LCA and its point of branching clearly, in all participants. Correction for magnification was done by calibrating the projected size of the Judkins® catheter to its actual size. This was achieved by auto-calibrating the catheter on the software used for analyzing the angiographic images. This calibration ensured that the values recorded are the actual and not the magnified sizes of the coronary vessels seen on the screen. The projected radiological angle between the origins of the anterior interventricular artery and circumflex artery (i.e., bifurcation angle) was measured (Left Anterior Oblique, caudal view) that shows the LCA and its point of branching clearly.

Statistical analysis was performed by using R for windows. Data expressed as mean and standard deviation. Normality was tested by using Kolmogorov--smirnov test. Students T-test was used to compare the length, diameter, and angle of division between the gender. The null hypothesis was rejected at $p < 0.05$.

Results

This study was carried out in two hundred and fifty healthy individuals out of whom one hundred and twenty-five were males. Age of study participants was 29.53 ± 5.13 . The demographic and clinical profile of the study participants were depicted in [Table 1].

Length, diameter, angle of division, and branching pattern of LCA were depicted in [Table 2]. Bifurcation of LCA was seen in 107 (85.6 %) males and 111 (88.8 %) females. Trifurcation of LCA was seen in seventeen (3.6 %) males and twelve (9.6) females. One male (0.8 %) and two (1.6 %) females have quadrification of LCA. Length of LCA was significantly high in females ($p < 0.00$) and diameter was more in males ($p < 0.02$) when compared to females. However, there was no significant difference across gender in angle of division of LCA. [Table 3]

Table 1: Demographic & clinical profile of the study population

Sl.No	Parameter	Mean + SD
1	Age	29.53 + 5.13
2	Gender (Male/Female)	125/125
3	Height	162.75 + 25.22
4	Weight	70.68 +14.00
5	HR	77.62 + 11.49
6	SBP	120.34 + 18.17
7	DBP	78.11 + 11.81
8	PP	42.27 + 7.04
9	RPP	9542.24 + 1452.24
10	HTN	Nil
11	DM	Nil
12	CAD	Nil
13	Thyroid	Nil
14	Asthma	Nil

Table 2: Branching pattern of LCA

Sl.no	Branching pattern	Mean + SD
1	LCA bifurcation	218 (87.2%)
2	LCA trifurcation	29 (11.6%)
3	LCA quadrification	3 (1.2%)
4	LCA length	8.00 + 1.50
5	LCA diameter	4.48 + 1.14
6	LCA angle of division	70.56 + 18.01

Table 3: Gender differences in measurements of LCA

Sl.No	Parameter	Male	Female	P value
1	LCA bifurcation	107 (85.6 %)	111 (88.8 %)	NA
2	LCA trifurcation	17 (13.6 %)	12 (9.6 %)	NA
3	LCA quadrification	1 (0.8 %)	2 (1.6 %)	NA
4	LCA length	8.40 + 1.11	17.98 + 1.05	0.00
5	LCA diameter	4.72 + 1.00	4.43 + 1.01	0.02
6	LCA angle of division	71.38 + 17.35	72.16 + 15.95	0.71

Discussion

Since decades, the anatomy of coronary arteries has been studied in various populations by cadaveric dissection, but no such study was conducted in Indian population to the best of our knowledge in regarding to analyse the dominance pattern, diameters of coronary arteries, segment wise measurement of coronary arteries, measurements of LCA and gender differences.

This study was carried out in two hundred and fifty apparently healthy individuals out of whom one hundred and twenty five were male. Age of study participants was 29.53 ± 5.13 . We have recruited one hundred and twenty five male, age matched female individuals to see the gender differences in various parameters.

Length, diameter, angle of division and branching pattern of LCA was depicted in [Table 2]. Bifurcation of LCA was seen in 107 (85.6 %) males and 111 (88.8 %) females. Trifurcation of LCA was seen in seventeen (3.6 %) males and twelve (9.6) females. One male (0.8 %) and two (1.6 %) females have quadrification of LCA. Length of LCA was significantly high in females ($p < 0.00$) and diameter was more in males ($p < 0.02$) when compared to females. However, no significant difference across the gender in angle of division of LCA.

It has been reporting that patients with small vessels are at a higher risk of having an adverse outcome following

placement of coronary stent due to a higher incidence of restenosis.^[9] In coronary artery bypass grafting, the most critical factor in predicting the success of the surgery is the size of the vessel to which the bypass is anastomosed.^[10] Reig & Petit,^[8] reported that "the longer the length of the LCA, the wider the angle of its division". But, there was no association between the length and its diameter of LCA. It also showed that no relation between the diameter of the LCA and its angle of division. As per the report by Saltissi et al., "the proximal location of atherosclerotic lesions in the branches of the LCA is associated with wider angle of division of the LCA". Hence, more the angle of division, possibility of atherosclerotic lesions distribution in the proximal segment of LCA branches will be higher, which may leads to myocardial infarction and ischemia.

Conclusion

Due to extensive use of radiographic images for diagnostic and interventional purposes, proper understanding of LCA anatomy is a critical issue. This study found a significant association between the length of the LCA and its angle of division. In-depth knowledge of the LCA anatomy and its variations is of clinical importance in the management of patients with CAD.

References

1. Srinath Reddy K, Shah B, Varghese C, Ramadoss A. Responding to the threat of chronic diseases in India. *Lancet*. 2005;366(9498):1744-9.
2. Angelini P, Villason S, Chan AV and Diez JG. Normal and anomalous coronary arteries in humans. In: Angelini, P (ed). *Coronary artery anomalies. A comprehensive approach*. Philadelphia, Lippincott Williams & Wilkins, 1999; pp 27-79. In.
3. Sinnatamby C.S., (2006). *Last's Anatomy*, eleventh edition, Churchill Livingstone; chapter 4, p:204-212. In.
4. Kalbfleisch H, Hort W. Quantitative study on the size of coronary artery supplying areas postmortem. *Am Heart*. 1977; 94: 183-188.
5. Loukas, M.; Groat, C.; Khangura, R.; Owens, D. G. & Anderson, R. H. The Normal and Abnormal Anatomy of the Coronary Arteries. *Clin. Anat.*, 22(1):114-28, 2009.
6. Fox, C.; Davies, M. J. & Webb-Peploe, M. M. Length of left main coronary artery. *Br Heart J.*, 35(8):796-8, 1973.
7. Gazetopoulos, N.; Ioannidis, P. J.; Marselos, A.; Kelekis, D.; Lolas, C.; Avgoustakis, D. & Tountas, C. Length of main left coronary artery in relation to atherosclerosis of its branches. A coronary arteriographic study. *Br Heart J.*, 38(2):180-5, 1976a.
8. Reig, J. & Petit, M. Main Trunk of the Left Coronary Artery: Anatomic Study of the Parameters of Clinical Interest. *Clin. Anat.*, 17(1):6-13, 2004.
9. Elezi, S.; Kastrati, A.; Neumann, F.; Hadamitzky, M.; Dirschinger, J. & Schömig, A. Vessel Size and Long-Term Outcome After Coronary Stent Placement. *Circulation*, 98(18):1875-80, 1998.
10. Abrams, H. L. Coronary Arteriography: Pathologic and Prognostic Implications. *AJR Am. J. Roentgenol.*, 139(1):1-18, July, 1982.

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