



Original Research Article

Analysis of gender influence on left main coronary artery dimensions in patient with coronary artery disease single center observational study

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ABSTRACT

Background: The aim of the study is to find out gender influence on the left main coronary artery (LMCA) dimensions in patients with coronary artery disease. Involvement of left main coronary artery in coronary artery disease makes it separate subset of ailment in terms of intervention and medical management point of view. Our objective is to find out the mean length and diameter of left main coronary artery in coronary artery disease patients. Whether gender has any correlation with these dimensions. Retrospective, single centre observational analytical study.

Materials and Methods: Study was conducted in Thanjavur Medical College. Department of Cardiology. From the coronary angiogram and case history of 77 coronary heart disease admitted in the department between July and August of 2021. Coronary angiogram was done in Phillips Allura XD Single plane catheterisation lab. Left main coronary artery dimensions were measured by quantitative coronary angiogram in LAO caudal view and in case of foreshortening few cases AP caudal view preferred for measurement. Measurements were done after calibration with diagnostic 5F Tiger Catheter in of the cases. Body surface area was calculated by Du bois formula. Data obtained was analysed by SPSS software.

Results: Left main coronary dimensions like mean diameter and mean length of LMCA were analysed against gender. Also influence of age, family history and co-morbid conditions were also analysed.

Conclusion: Mean Left main coronary artery diameter is significantly associated influenced by gender with male have higher value than females without indexing to body surface area.

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1. Introduction

Left main coronary artery (LMCA) is very important by virtue of its origin from aorta and its two branches supplies left chambers (Left ventricle and left atrium). The left main coronary artery divides into left anterior descending artery (LAD) and left circumflex artery (LCX). Before branching LMCA run for 5 to 10 mm as it passes to left and posterior to pulmonary trunk. 20% of patients left dominant where posterior descending artery territory is supplied by LAD or LCX. In 15% of patients the LMCA trifurcates into

LAD, LCX, and ramus intermedius arteries.¹ LMCA arises from Left coronary cusp rarely arises from right coronary cusp. Occasionally LAD and LCX arises separately or from common ostium thereby literally no LMCA present. Very rarely LMCA arises from pulmonary artery. There are several post-mortem studies regarding dimensions of coronary arteries.² Age, sex, body weight, body surface area, weight of the heart and ethnic/racial factors have been correlated with coronary artery anatomy in various studies.³ There have been few estimates of normal coronary artery dimensions based on electronic calliper measurements from cine angiographic films.⁴ It has been shown that men have

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larger coronaries than women. Left ventricular hypertrophy and dilated cardiomyopathy are also associated with larger coronaries.^{1,3} Coronary artery size in Indians has been reported to be significantly smaller when compared to western population.⁵ O Connor et al found that females have smaller coronary artery diameter and related to more perioperative mortality.

Gender thus significantly influences diameter of the left and right coronary arteries which may necessitate gender specific approaches during coronary angioplasty and coronary artery bypass grafting.⁶ Women have higher age related incidence and poor prognosis of myocardial infarction, which may also be due to smaller coronaries compared to men.⁷ Male patients have larger diameter with a significant p- value for LMCA, proximal Left anterior descending artery, Left circumflex artery and Right coronary artery than female patients.⁸ Most of the studies which involved coronary artery diameter analysis had revealed that women had smaller coronary artery diameter compared to men.⁹ Gender considered as significant predictor of clinical characteristics and out comes following coronary revascularisation procedures.^{10,11}

2. Aim

The aim of the study is to find out gender influence on the dimensions of the Left Main Coronary Artery namely mean diameter and mean length in a given geographical area by analysing the data retrospectively in single centre for a given period.

3. Objective

The objective of the study is to find the influence of gender on left main coronary artery (LMCA) dimensions. LMCA is unique in its clinical manifestation, interventional aspects and therapeutic point of view. Dimension plays an important role in choosing the modality of treatment and the outcome also varies accordingly. Choosing the hardware and the preparedness of the LMCA procedures needs high degree of expertise and expert teamwork to give good outcome. Apart from overall coronary artery dimension which vary from individual to individual whether the LMCA dimensions has association with basic variables like age, sex and body surface area are the secondary objectives of the study.¹²

4. Materials and Methods

It is a retrospective, single centre observational analytical study and was conducted in Thanjavur Medical College. Department of Cardiology. From the coronary angiogram and case history of 70 (seventy) coronary heart disease patients admitted in the department of cardiology between July and August of 2021. Coronary angiogram was done in Phillips Allura XD Single plane catheterisation lab. Left main coronary artery dimensions were measured by

quantitative coronary angiogram with reference to 5 F Tiger diagnostic catheter diameter. Few cases 5F Judkin's diagnostic catheter were used. The dimensions of LMCA was measured as a function of the catheter diameter and the absolute diameter in millimetre was evaluated by automated software analysis (Figure 1 A,B). Preferred view was LAO (Left anterior oblique) caudal view and in case of foreshortening few cases AP caudal view utilised for measurement. Measurements were done after calibration with diagnostic 5F Tiger Catheter in most of the cases. Femoral cross over was done in difficult radial approach. Body surface area was calculated by Du bois formula ($0.20247 \times \text{Height (m)}^{0.725} \times \text{Weight (kg)}^{0.425}$). Data obtained was analysed by SPSS software.

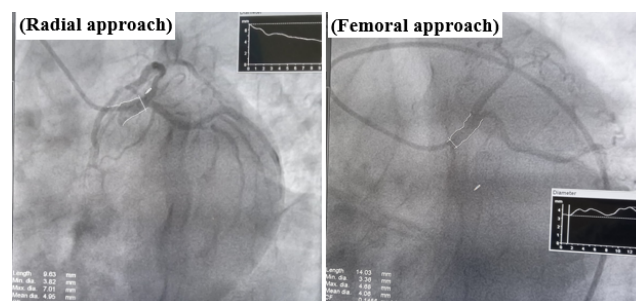


Figure 1: A: LAO Caudal view; B : LAO caudal view

4.1. Inclusion criteria

All patients who have given consent with coronary artery disease who have undergone coronary angiogram in the prescribed time period, of all age groups and both sexes were included in the study.

4.2. Exclusion criteria

Those patients with normal epicardial coronaries and those who have anomalous coronary origin like separate origin of left anterior descending artery and left circumflex artery were excluded. Patients with LAD and LCX with common ostium and literally no LMCA were also excluded from the study, since it may lead to under estimation of final measurements.

5. Results

Out of seventy patient's analysed minimum age and maximum age found to be 34 years and 73 years respectively. Other baseline characteristics were also analysed. Both height and weight had standard deviation of 7.439 and 7.755. Important parameter body surface area had standard deviation of 0.12801 with minimum 1.35 kg/m² and maximum of 1.96 kg/m². Regarding sex distribution female 27.1% with frequency of 19 and male 72.9% with frequency of 51. Height with minimum of 145 cm and

Table 1: Baseline characteristics

Parameters	N	Minimum	Maximum	Mean	Std. Deviation
Age	70	34	73	51.93	10.971
HT	70	145	175	158.77	7.439
WT	70	46	80	63.73	7.755
BSA	70	1.35	1.96	1.6459	0.12801
PR	70	59	104	80.11	11.095
LMCA L	70	1.60	11.60	6.6796	2.19875
LMCAMED	70	2.20	5.60	3.9629	0.61365
EF	70	29	60	46.90	7.096

HT- Height, WT- Weight, BSA- Body Surface Area, PR- Pulse rate, LMCA L- Left Main Coronary Artery, Length, LMCA MED- LMCA Mean Diameter, EF- Ejection fraction.

Table 2: Co-morbidities

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	DM	13	18.3	32.9
	DM,H	17	2.9	92.8
	H	20	28.6	50.0
	NIL	20	28.6	100.0
	Total	70	100.0	

DM- Diabetes Mellitus, H- Hypertension

Table 3:

	Sex	N	Mean	Std. Deviation	T value	P value
Age	Male	51	52.10	11.332	0.210	P=0.834
	Female	19	51.47	10.216		
HT	Male	51	160.45	6.178	3.311	P=0.001S
	Female	19	154.26	8.755		
WT	Male	51	64.92	7.277	2.164	P=0.034S
	Female	19	60.53	8.282		
BSA	Male	51	1.6673	0.11314	2.366	P=0.021S
	Female	19	1.5884	0.14994		
PR	Male	51	79.69	10.827	-0.526	0.601
	Female	19	81.26	12.013		
LMCA L	Male	51	6.7451	2.23815	0.406	0.686
	Female	19	6.5037	2.13839		
LMCAMED	Male	51	4.0706	0.59272	2.496	P=0.015S
	Female	19	3.6737	0.58864		
EF	Male	51	46.02	6.857	-1.725	0.089
	Female	19	49.26	7.370		

S—significant. HT- Height, WT- Weight, BSA- Body Surface Area, PR- Pulse rate, LMCA L- Left Main Coronary Artery Length, LMCA MED- LMCA Mean Diameter, EF- Ejection Fraction.

maximum 175 cm. Standard deviation being 158.7 and 63.3 respectively. LMCA mean diameter minimum 2.2cm and maximum 5.6 cm for the studied patients. Standard deviation of LMCA mean diameter is 0.61. LMCA length is minimum 1.6 cm and maximum 11.6 cm with standard deviation 2.19. (Table 1) Regarding sex distribution female 27.1% with frequency of 19 and male 72.9% with frequency of 51.

Alcoholism and smoking was found to be the common bad habits. (Table 2) Smoking was associated with 27.1 percent of the cases with cumulative percent 81.4. Those who had both smoking and alcoholism constituted 18.6

percent.

Our study group had very strong association with family history 78.6%. While analysing co-morbid conditions systemic hypertension in isolation was more commonly associated with coronary artery disease (28.6%). Diabetes mellitus was associated with 18.3 % of patients. Only 2.9 % of patients had both systemic hypertension and diabetes mellitus.(Table 2).

Regarding thrombolysis 40 out of 70 patients has come within time window of 6 hours undergone thrombolysis with Inj. Streptokinase. Remaining patients are either elective or came beyond time window period Left main coronary

artery mean length is 6.7 mm for male and 6.5 for female (Table 3). Standard deviation is 0.406. P value is 0.686 which is insignificant and the T value is 0.406. P value is statistically insignificant. Higher the T value indicates large difference exists between the two sample sets. Smaller the T value more similarity exists between two sets. Any T value greater than +2 and lesser than - 2 is significant. Considering the above T value difference between the male and female LMCA diameter is insignificant.

Left main coronary artery mean diameter is 4.0 mm for male and 3.6 mm for female. Standard deviation is 0.59 for male and 0.58 for female. P - value is 0.015 which is significant and the T value 2.496 which is also very significant indicating male and female LMCA mean diameter differs in male and female and it is lesser for women compared to men. Apart from above findings height, weight and BSA variables in our patients having coronary artery disease taken up for procedure have gender wise differ which is appreciated by significant P value P-0.001, P-0.034 and P- 0.021 respectively.

6. Discussion

Computed size of coronary arteries when not indexed to body surface area is significantly higher between Indians and Caucasians as per Lip et al.⁵ According to Barendra Kumar Raut, George cheriyan original article Coronary Artery Dimensions in Normal Indians¹³ is 2.34±0.28 cm for male patients and 2.33±0.27 for female patients with 2.34±0.28 mm P Value >0.05. This study was conducted on a sample of 229 patients. When indexed to Body surface area, Caucasians showed significant larger coronary arteries with P Value <0.05. In our study only the left main coronary artery mean diameter unadjusted against body surface area is significant with P value 0.015 with standard deviation 0.59 for male and 0.58 for female.

In AIIMS study which was conducted which was conducted with sample size of 94 patients LMCA mean diameter was 2.16 ±0.42 mm with P value of > 0.05 adjusted against BSA.^{14,15} Whereas in Birmingham study which was conducted on a sample of 77 patients mean diameter of LMCA was 2.38 ± 0.47 mm with P- value of >0.05 adjusted against body surface area.⁵ In both studies dimensions were significant when unadjusted against BSA similar to our study with P value less than 0.05. In AIIMS study M:F is 63: 31 and in Birmingham study M:F 39:38. In our study male Vs female sex ratio is 51:19 male patients predominant in study population. C. Elangovan et al. study was carried out on normal coronary angiogram which concludes women have smaller coronary after correction for body surface area. Coronary angiograms with evidence of localised atheroma, coronary spasm, and previous history of myocardial infarction were excluded in study, Quantitative and qualitative coronary angiographic analysis: review of methods, utility and

limitations conducted by J.B. Hermiller, J.T. Cusma. L.A. Spero. D.F. Fortin Barendra Kumar Raut¹⁶ Coronary artery dimensions in Normal Indians¹³ study was conducted on cases with normal coronary artery on angiogram whereas our study was conducted in patients who had coronary artery disease.

Cases with normal coronaries were never included in our study. Our study is of more clinical significance as it was conducted on diseased coronary arteries. But when compared with sample size our study sample is comparatively smaller only 70 cases as against 229 cases in the above mentioned study which can be extrapolated to larger population though both are single centre studies.

Gender specific and age- dependent significant correlation between RCA diameter and body mass index among male samples were observed.¹⁷ Significant correlation between LMCA cross sectional area with height, weight, and bod surface area among male samples were observed.¹⁸ Women have higher age related incidence and poor prognosis of myocardial infarction, which may also be due to smaller coronaries compared to men.⁷ To assess the extent and direction of arterial remodelling in vivo among individual lesions, it is necessary to compare vessel size at the lesion site to an adjacent reference site that contains minimal disease.¹⁹ Gender significantly impacts proximal LAD and RCA size even after normalising for body surface area (BSA) and cardiac mass. This explains the gender-related risks with coronary artery revascularisation.²⁰ Differences in disease outcome between women and men can be related to vascular biological factors such as smaller vessel size and functional differences of smooth muscle atheroma burden in women.²¹

7. Conclusion

Unadjusted to body surface area Left main coronary artery median diameter is high in males when compared to female, not the mean length of left main coronary artery. Height, weight and body surface area are significantly higher in men in our study group when compared against female. Association of family history in male CAD (Coronary artery disease) patients is not significant in our study group with gender comparison, though family history is a risk factor in CAD patients without gender comparison.

8. Limitations

Left main coronary artery dimensions is not indexed to Body surface area.

Sample size is smaller to extrapolate the results to general population. Interpretation done on subset of population in a single centre who have undergone coronary angiogram by convenient sampling method, making it prone for bias.

9. Conflict of Interest

None.

10. Source of Funding

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