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CORONARY ARTERY DIMENSIONS IN NORMAL RURAL INDIANS

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ABSTRACT

Background: Diameter of coronary artery is an important predictor of outcome after percutaneous coronary interventions and coronary artery bypass graft surgery. There is very limited data available about coronary artery dimensions in a rural population.
Aims: To study the normal dimensions of the coronary artery segments in Rural Indians without coronary artery disease by using quantitative coronary angiography and also to compare the dimensions in Rural Indians with Western.
Material and method: 179 patients who have undergone coronary angiography with entirely normal coronary angiogram were included in our study.
Results: This study showed the diameter of vessels in males and females when taken together the left main was larger in size followed by proximal LAD, proximal RCA & proximal LCX respectively (3.86+/- 0.44 mm, 3.12 +/- 0.23 mm, 3.08 +/_ 0.37 mm, 2.87 +/_0.37 mm). When the vessel diameter was indexed to body surface area there was no statistical difference between male and female (p value > 0.05). The computed value of proximal coronary artery diameter unadjusted for individual body surface area, when compared to Caucasians showed that Caucasians have larger coronary artery dimensions than Rural Indians. But when the proximal vessel diameter was indexed to body surface area there was no statistical significant difference between Rural Indians and Caucasians (p value > 0.05).
Conclusions: We found that coronary artery size when indexed to body surface area is not statistically different in Rural Indian males and females as compared to Caucasians. However with a smaller body habitus of Rural Indians have smaller coronary arteries.

1. Introduction

Current understanding and development regarding coronary atherosclerosis are predicated on the understanding of the normal coronary anatomy. There are several postmortem studies regarding dimensions of coronary arteries. However there are only few studies regarding real life dimensions. Size of the coronary artery is an important predictor of outcome after percutaneous coronary interventions (PCI) and coronary artery bypass graft surgery (CABG). Coronary artery dimensions are influenced by age, sex, anatomic variation, left ventricular hypertrophy or dilatation and body mass index.[1] It has been shown that men have larger coronaries than women. Left ventricular hypertrophy and dilated cardiomyopathy are also associated with larger coronaries.[1] Only limited data is available about coronary artery dimensions in an Indian population.[2,3] The aim of this study was to determine coronary artery dimensions in Rural Indian population with angiographically normal arteries.

2. Method

We studied 179 patients who had coronary angiography and were found to have normal coronary angiogram based on visual assessment of absence of any luminal irregularities. Patients with history of diabetes mellitus, hypertension, renal disease, valvular heart disease, cardiomyopathy, abnormal ECGs, abnormal echo report were excluded. Coronary angiography was performed by femoral route with 5f/6f Judkin's or Amplatz right and left catheter. Standard projections were taken for visualization of main epicardial coronary arteries on Innova 2000 and 2100 imaging system. Coronary angiograms with evidence of localized atheroma, coronary spasm and previous history of myocardial infarction with recanalised arteries were excluded. The dimension of the coronary artery was then measured with reference to the catheter diameter.[4] The dimensions of the coronary artery were measured as a function of the catheter diameter and the absolute diameter in millimeter (mm) was calculated by automated software analysis. No intracoronary nitroglycerin was administered prior to acquisition of images. The measurements were taken in diastole. Each artery was measured in the defined segments and measurements taken of the widest diameter of the segment (Fig. 1). Statistical analysis done with student t-test and independent 't' test. The statistically significant p value in all these tests was assumed at a value < 0.05.

3. Results:

We studied 179 patients out of which 101 were males and 78 females and the mean age of the patients was 51.70 +/- 9.35 years (range 23–76 years). Physical and demographic parameters were assessed. The average weight was 67.16 6.31 kg (range 80.00–48.00 kg), height was 165.18 6.80 cm (range 182.00–139.00 cm) and BMI was 24.59 1.48 kg/m2 (range 31.30–21.26 kg/m2). Mean body surface area was 1.75 0.11 m2 (range 1.36–1.99 m^2).

The right coronary artery was dominant in 59.83%, with co-dominance in 23.14% and left dominance in 17.03%. When the diameter of vessels in males and females was taken together the left main was largest in size followed by proximal LAD, proximal RCA & proximal LCX respectively (4.08 0.44 mm, 3.27 0.23 mm, 3.20 0.37 mm, 2.97 0.37 mm). The size of proximal segments of coronary system was larger in males compared to females without reference to the BSA (Fig. 2). The coronary artery diameter indexed to body surface area of left main, proximal LAD, proximal RCA and proximal LCX were 2.34 0.28 mm, 1.87 0.21 mm, 1.83 0.22 mm and 1.70 0.23 mm respectively. Our study showed that when the size of the vessel, was indexed to the BSA, there was no statistical significant difference between males and females (p value > 0.05) (Table 1).

The proximal vessel size in relation to BSA in the present study was compared to other studies to find if there was a significant difference between Indians and Caucasians. The diameter of proximal coronary segments of our study, unadjusted for BSA, when compared to Caucasians, showed statistical significant difference with Caucasian arteries being larger, (p value < 0.05). However when indexed to BSA, the size of the proximal coronary system was not statistical significant different between Rural Indians and Caucasians (Table 2)

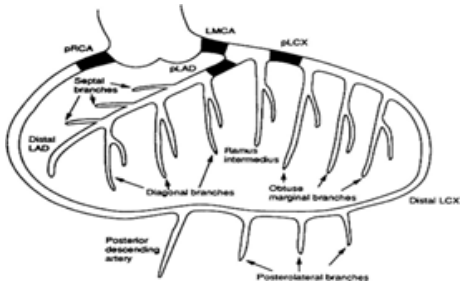

Fig. 1. Coronary artery map- darkened area taken for reference diameter.

[LMCA: Left Main Coronary Artery.

PLAD: Proximal Left Anterior Descending Artery (before 1st septal branch).

PLCX: Proximal Left Circumflex Artery (before 1 st obtuse marginal).

PRCA: Proximal Right Coronary Artery (before 1 st acute marginal)].

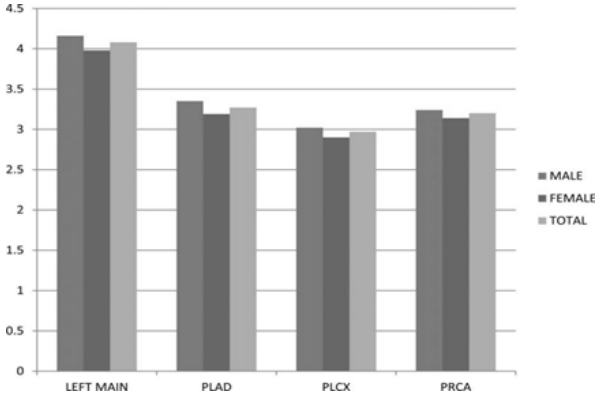

Fig. 2. Coronary artery dimensions (in mm) in both sexes. (Left main artery, PLAD- proximal left anterior descending artery, PLCX- proximal left circumflex artery, PRCA- proximal right coronary artery).

Table 1

Coronary artery	MALE	Female	Total	p value
Left main	2.34 0.28	2.33 0.27	2.34 0.28	>0.05
PLAD	1.88 0.17	1.86 0.20	1.87 0.21	>0.05
PLCX	1.70 0.22	1.69 0.23	1.70 0.23	>0.05
PRCA	1.82 0.22	1.83 0.21	1.83 0.22	>0.05

Coronary artery diameter indexed to body surface area: When the size of the vessel when indexed to body surface area, there was no statistical significant difference between males and females (p value > 0.05).

PLAD- proximal left anterior descending artery, PLCX- proximal left circumflex artery, PRCA- proximal right coronary artery.

4. Discussion

The dimensions of the coronary arteries are highly variable in the normal population.[4] The determinants of coronary artery size are not well understood. Genetic factors undoubtedly play an important role.[1] Age, sex, body weight, BSA, weight of the heart and ethnic/racial factors have all been correlated with the coronary artery anatomy in various studies.[1] Many of these studies were either injection studies in post mortem specimens or dissection studies. There have been numerous reports on the size of coronary arteries in post mortem studies. Several correlations between heart weight & lumen size of the coronary arteries have been made from these studies. The inherent fallacy of these studies has however been the various factors involved in the procurement, preservation, fixation & analysis of the epicardial coronary arteries thereby vitiating, the validity of these observations in estimating the true dimension of coronary arteries.

There have been very few estimates of normal (undiseased) coronary artery size during life based on visual estimates or electronic calliper measurements from cine-angiographic films.[5] In this prospective study we attempted to establish a database for normal dimensions of the coronary artery segments during life by using quantitative coronary angiography and also to compare the dimensions in Indians without coronary artery disease with western estimates of coronary artery size.

Quantitative coronary angiography (QCA)[4] has been developed with the purpose of geometric assessment of epicardial coronary artery abnormalities since visual interpretation of coronary angiograms is inherently flawed & observer dependent. Several studies have validated the accuracy of digital quantitative estimation of coronary dimensions.[5,6]

We applied the principles of quantitative coronary angiography for assessment of angiographically normal coronary artery seg-ments in 179 patients who had undergone cardiac catheterization & angiography for evaluation of symptoms suggestive of coronary artery disease.

Coronary artery size in Indians has been reported to be significantly smaller when compared to that of the western population.[7] This has been attributed to body habitus, build & BSA. Lip et al.[7] reported that though the unadjusted angiographically estimated mean diameters of various coronary artery segments in the western population among Caucasians were higher than those of Indian Asians, there was no statistically significant difference when the same values were compared and expressed as mean coronary artery diameter per unit BSA. They concluded that the smaller size of the coronaries in Indian Asians is attributable to their smaller BSA. Similar findings have been reported by Dhawan et al.[5] who compared the cross sectional coronary area derived from angiographically estimated coronary diameter among Asian and Caucasian patients.

Table 2 Comparative studies showing coronary artery dimensions when indexed to BSA (in mm).

Comparative studies indexed to BSA

Coronary artery	Present study	AIIMS study[3]	Birmingham study[7]	p value
	n = 179	n=94	n = 77	
	(M:F 101:78)	M:F 63:31	(M:F 39:38)	
Left main	2.04 +/- 0.28	2.16 0.42	2.38 0.47	>0.05
PLAD	1.69 +/- 0.21	1.69 0.37	1.89 0.37	>0.05
PLCX	1.66 +/- 0.23	1.67 0.37	1.71 0.32	>0.05
PRCA	1.73 +/- 0.22	1.89 0.39	1.79 0.39	>0.05

AIIMS = All India Institute of Medical Sciences.

In our study it was found that male patients had statistically significant larger coronary artery dimensions compared to that of females unadjusted for individual BSA (p value < 0.05). When the vessel diameter was indexed to BSA there was no statistical difference between male and female (p value > 0.05). This finding contradicts the traditional belief of females having smaller coronary artery compared to males. Our finding differs from the finding of Elagovan et al.[2] who have found that females have smaller dimension of coronary artery after correction for BSA. Dhall et al. is also studied histomorphic analysis of human coronaries and found similar findings.[8] Even O'Connor NJ et al. found that females have smaller coronary artery diameter and related to more perioperative mortality.[9]

The computed value of proximal coronary artery diameter unadjusted for individual body surface area in the present study when compared to Caucasians showed that Caucasians have larger coronary artery dimensions than Rural Indians but when the proximal vessel diameter was indexed to BSA there was no statistical significant difference between Rural Indians and Caucasians (p value > 0.05). This finding is in concordance with the observations of Lip et al.[7]

5. Conclusions

We found that the indexed size of coronary arteries in Rural Indian males and females of rural population is the same. The traditional belief of Indians having smaller coronary arteries is not entirely true. We found that coronary artery size when indexed to BSA was not statistically different in Rural Indians as compared to Caucasians. It is also independent of gender. Rural Indians have small size coronary artery because of their smaller body surface area. This has great relevance to the performance and results of interventional procedures like angioplasty and coronary artery bypass graft surgery.

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