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ORIGINAL ARTICLE

A Quantitative Investigation of Gender-Related Variations in Coronary Artery Diameters

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ABSTRACT

Objective: To evaluate the association between gender and coronary artery diameter at the cardiac ward of a tertiary care hospital.

Background: Understanding the normal structure of the coronary arteries is essential for accurately describing the amount of coronary atherosclerosis. However, studies on the true normal coronary arteries' luminal diameters are scarce. Although numerous studies have assessed the post-mortem coronary artery dimensions. A few studies have been conducted in living patients with presumed normal arteries utilizing quantitative coronary arteriography techniques

Study Design: A cross-sectional study

Place and Duration: This study was conducted at Peoples University of Medical and Health Sciences for women Nawabshah from December 2021 to December 2022.

Methodology: The study has 121 participants. The statistical analysis was performed using SPSS version 23. We used the t-test to analyse the connection between numerical and categorical variables. A P value of 0.05 or less was considered statistically significant in every case. The patient identification number was substituted for the patient's name, angiography film number, and medical record number in the proforma, and each patient's identity was kept private. Films from coronary angiography that were deemed to be normal were gathered and examined.

Results: In the present study, males were in higher proportion compared to the females with 53.72 % against 46.28%. The mean age of females was 54.9 ± 8.3 and the mean age of males was 58.7 ±9.1 Years. The mean body surface area (BSA) for males was 1.79 ±0.07 and the mean BSA for females was 1.73 ±0.02.

Conclusion: Although multiple alternative explanations for the difference in coronary dimensions with gender and age have been discussed, however, in our results, coronary dimensions didn't show a significant association with gender. There is still huge space for large-scale studies on the subject.

Keywords: Coronary artery diameters, Gender Association, comparison

INTRODUCTION

Understanding the normal structure of the coronary arteries is essential for accurately describing the amount of coronary atherosclerosis. However, studies on the true normal coronary arteries' luminal diameters are scarce. Although numerous studies have assessed the post-mortem coronary artery dimensions [1-4]. A few studies have been conducted in living patients with presumed normal arteries utilizing quantitative coronary arteriography techniques [5, 6]

Because the precise diameter of the coronary arteries must be established before performing any interventional therapy, the decreased sizes of particular coronary artery segments have important diagnostic and therapeutic implications [7]. According to published research, smaller vessels with a diameter of less than 2.5 mm are more likely than bigger veins to have obstruction or thrombosis [8].

In comparison to a vessel with a diameter of 3.5 mm, a 2.5 mm vessel with a moderate level (60%) stenosis would have more severe adverse effects on blood flow since the former vessel has a smaller cross-sectional area. Therefore, a vessel with a smaller diameter would experience a significant occlusion at a moderate degree (60%) of stenosis, which would significantly affect coronary artery revascularization [9].

Following coronary revascularization, the clinical outcomes for women appear to be worse. It is debatable if there is a gender-specific difference in vessel size that accounts for this finding. Therefore we have conducted this study with the aim to evaluate the association between gender and coronary artery diameter.

METHODOLOGY

A cross-sectional descriptive study was carried out at our hospital. The sample size was calculated using a 95% confidence level and a 90% power of the test. After reviewing the literature, we expected the distal right coronary artery's mean diameter to be 1.69 mm [8], with a standard error of 0.15. There were 121 subjects in the study. Patients advised for angiography but with normal coronary angiograms were made part of the study (records of normal coronary angiograms were acquired from the files available in the hospital records. Patients of either gender with normal angiograms aged 18 years were eligible for inclusion in the study. Dilated cardiomyopathy (DCMP), Left ventricular hypertrophy (LVH), and patients who had I/V vasodilators administered during angiography were all excluded from the research Ethical approval was obtained from the ERB of our hospital.

In our Study, the patient identification number was substituted for the patient's name, angiography film number, and medical record number in the proforma, and each patient's identity was kept private. Films from coronary angiography that were deemed to be normal were gathered and examined.

The baseline variables (including co-morbidities) from each patient's medical history file and angiography film included age, gender, weight, height, serum creatinine, LVH, and DCMP were recorded. Body surface area (BSA) was calculated by height (cm) multiplied by weight (Kg) and divided by 3600.

The statistical analysis was performed using SPSS version 23. Descriptive statistics were used to describe demographic data (such as weight, height, body surface area, etc.).The student's t-test was used to compare quantitative demographic and clinical characteristics between male and female subjects, while the Chi-square test was used to evaluate categorical data. We used the t-test to analyse the connection between numerical and categorical variables. A P value of 0.05 or less was considered statistically significant in every case.

RESULTS

In the present study, males were in higher proportion compared to the females with 53.72 % against 46.28%. (As shown in Figure I).

The mean age of females was 54.9 ± 8.3 and the mean age of males was 58.7 ±9.1 Years. The mean BSA for males was 1.79 ±0.07 and the mean BSA for females was 1.73 ±0.02. Table 1 describes the mean and standard deviation of various numerical variables in the study.

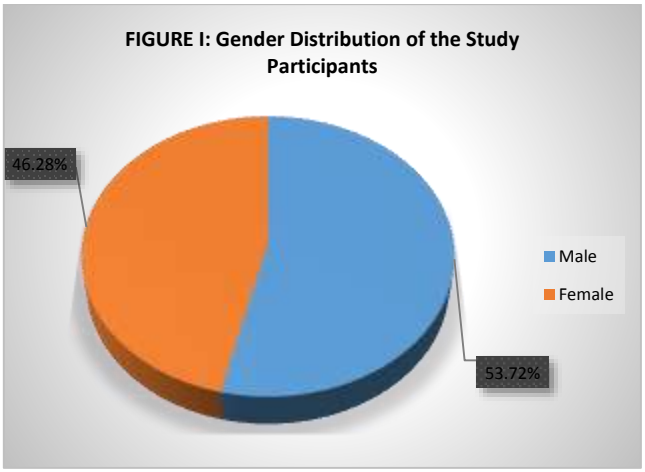

Table 1: Various Characteristics of study participants (n=110)

Characteristics	Females (mean)	SD	Males (mean)	SD	p-value
Age (years)	54.9	±8.3	58.7	±9.1	0.602
BMI (Kg/m^2)	28.1	±2.1	26.8	±2.3	0
BSA (m^2)	1.73	±0.02	1.79	±0.07	0
Serum Creatinine (mg/dl)	0.97	±0.09	0.87	±0.21	0.673
Systolic Blood Pressure(mmHg)	139.5	±14.2	138.1	±12.1	0.456
Diastolic Blood Pressure (mmHg)	81.3	±7.9	77.7	±9,.8	0.405
Pulse/minute	79.9	±6.2	76.8	±6.34	0.344

Coronary artery diameters according to gender are presented in Table II. The diameter of the Proximal left anterior descending (PLAD) was smaller in females compared to males, while the diameter of the Proximal Left Circumflex (PLCx) was larger in females compared to males. The diameter of MLAD and DLCx was larger in males compared to females. The rest of the parameters (MRCA, PRCA, DLAD and) were larger in females than in males.

Table 2: Coronary Artery data of study participants

Coronary artery	Male patients (n = 65)	SD	Female patients (n = 56)	SD	p-value
Left main stem	2.123	±0.21	2.142	±0.171	0.501
P LAD	1.94	±0.111	1.799	±0.182	0.612
M LAD	1.52	±0.20	1.512	±0.199	0.378
D LAD	0.91	±0.166	0.999	±0.21	0.059
PLCx	1.59	±0.21	1.812	±0.31	0.052
D LCx	1.21	±0.155	1.141	±0.21	0.064
P RCA	1.49	±0.191	1.701	±0.287	0.059
M RCA	1.21	±0.198	1.31	±0.299	0.215
D RCA	0.799	±0.212	0.85	±0.31	0.075

DISCUSSION

In the general population, it has been discovered that the sizes of the coronary arteries vary greatly [10]. Numerous studies have shown that the morphology of coronary arteries is influenced by genetic factors such as age, gender, weight and racial factors.[11, 12].

Prior research on the average human coronary diameters was mostly done on postmortem hearts [1-4].Although the majority of these studies measured the coronary arteries under physiologically displacing pressures, changes in the smooth muscle's distensibility after death may have an impact on the coronary artery's true caliber. Additionally, dynamic variations in coronary blood flow are not taken into consideration in postmortem research. Determining the size of the coronary arteries using an angiogram during diastole may therefore not be possible from a necropsy examination. Additionally, preexisting cardiac conditions such as left ventricular hypertrophy, cardiomyopathy, valvular heart disease, and congenital heart disease that could impact coronary dimensions are frequently present in the hearts investigated in postmortem research. For these reasons, it is questionable whether pathological information can be applied to veins evaluated in vivo under normal distending pressure [13-16].

In the present study, males were in higher proportion compared to the females with 53.72 % against 46.28%.This difference is perhaps because of the general differences in the patient presentation.

In this study, the mean age of females was 54.9 ± 8.3 and the mean age of males was 58.7 ±9.1 Years. The mean BSA for males was 1.79 ±0.07 and the mean BSA for females was 1.73 ±0.02. The average body surface area (BSA) of the study participants was 1.84 0.17, which is comparable to the BSA of Caucasians in Lip et al.'s study (1.88 0.19), South Asians in Hasan et al.'s study (1.86 0.20), and the BSA of South Asians in another Pakistani study (1.8004 0.11). Although the mean body surface area in studies on Asians and Indians by Lip et al. was lower than that in our study, at 1.68 0.17 and 1.77 0.15, respectively [8, 9, 20, 21]

Results from published data on how age affects normal coronary dimensions are contradictory [17, 18]. Three postmortem studies have found a minor tendency for adult coronary size to expand with age. However other postmortem studies [14–16] have not found any difference in coronary size with age.

In our study, the diameter of the Proximal Left Anterior Descending (PLAD) was smaller in females compared to males, while the diameter of the Proximal Left Circumflex (PLCx) was larger in females compared to males. The diameter of MLAD and DLCx was larger in males compared to females. The rest of the parameters (MRCA, PRCA, DLAD and) were larger in females than in males. In our study, the diameters of the PRCA, PLAD, MLAD, and DLAD PLCx are greater, and the diameters of the left main and MRCA are smaller, compared to patients of South Asian descent in Hasan et al.'s study[20].However, even after indexing with body surface area, it had been demonstrated in a few studies[22, 23] that males had larger coronary arteries than females. The difference between male and female patients' left main stem and DLCx was shown to be statistically significant in an Indian investigation, but it was not significant for PLCx,[9].

CONCLUSION

Although multiple alternative explanations for the difference in coronary dimensions with gender and age have been discussed, however, in our results, coronary dimensions didn't show a significant association with gender. There is still huge space for large-scale studies on the subject.

REFERENCES

1 Ehrlich W, de la Chapelle C, Cohn AE: Anatomical ontogeny: A study of the coronary arteries. Am JAnat 1931; 49:241-282
2 Hutchins GM, Bulkley BH, Miner MM, Boitnott JK: Correlation of age and heart weight with tortuosity and caliber of normal human coronary arteries. Am Heart J 1977; 94:196-202
3 Rodriguez FL, Robbins SL: Capacity of human coronary arteries: A postmortem study. Circulation 1959; 19:570-578
4 Wilens SL, Plair CM, Henderson DH: Size of the major epicardial coronary arteries at necropsy: Relation to age, heart weight, and myocardial infarction. JAAA 1966; 198:1325-1329
5 MacAlpin RN, Abbasi AS, Grollman JH, Eber L: Human coronary artery size during life: A cinearteriographic study. Radiology 1973; 108:567-576

6 Vieweg WVR, Alpert JS, Hagan AD: Caliber and distribution of normal coronary arterial anatomy. Cathet Cardiovasc Diagn 1976; 2:269-280

7 Wilsens SL, Plair CM, Henderson D. Size of the major epicardial coronary arteries at necropsy: relation to age, weight and myocardial infarction. JAMA 1966; 198(13):1325-9.

8 LipGY,RathoreVS,KatiraR,WatsonRD,SinghSP.DoIndo-Asians have smaller coronary arteries? PostgradMedJ1999; 75(886):463-6.

9 Saikrishna C, Talwar S, Gulati G, Kumar AS. Normal coronary artery dimension in Indians. Ind J ThoracCardiovasSurg2006; 22(3):159-64.

10 Lewis CM, Dagenais GR, Riesinger GC, Ross RS.Coronary arteriographic appearances in patients with left bundle branch block. Circulation 1970; 41(2):299-307.

11 Dhawan J, Bray CL. Angiographic comparison of coronary artery disease between Asians and Caucasians. Postgrad MedJ1994; 70(827):625-30.

12 DhawanJ ,BrayCL. Are Asian coronary arteries smaller than Caucasian? A study on angiographic coronary artery size estimation during life. Int J Cardiol1995; 49(3):267-9.

13 Ehrlich W, de la Chapelle C, Cohn AE: Anatomical ontogeny: A study of the coronary arteries. Am JAnat 1931; 49:241-282

14 Hutchins GM, Bulkley BH, Miner MM, Boitnott JK: Correlation of age and heart weight with tortuosity and caliber of normal human coronary arteries. Am Heart J 1977; 94:196-202

15 Rodriguez FL, Robbins SL: Capacity of human coronary arteries: A postmortem study. Circulation 1959; 19:570-578

16 Wilens SL, Plair CM, Henderson DH: Size of the major epicardial coronary arteries at necropsy: Relation to age, heart weight, and myocardial infarction. JAAA 1966; 198:1325-1329

17 Neufeld HN, Wagen voort CA, Edwards JE: Coronary arteries in fetuses, infants, juveniles and young adults. Clin Invest 1962; 11:837-844

18 Orlandini GE. Ulteriori osservazioni sulle circonferenze delle arterie coronariche. Boll Soc It Biol Sper. 1968;44:243-4.

20 Hasan RK, Ginwala NT, Shah RY, Kumbhani DJ, Wilensky RL, Mehta NN. Quantitative angiography in South Asians reveals differences in vessel size and coronary artery disease severity compared to Caucasians. American journal of cardiovascular disease. 2011;1(1):31.

21 Faridullah, Adil M, Nadeem M, Hafizullah M, Jan H. Comparison of left coronary artery diameter among diabetics and non-diabetics. J Postgrad Med Inst2012; 26(4):369-76.

22 Zindrou D, Taylor KM, Bagger JP. Coronary artery size and disease in UK South Asian and Caucasian men. European journal of cardio-thoracic surgery. 2006 Apr 1;29(4):492-5.

23 Dodge JT, Brown BG, Bolson EL, Dodge HT. Lumen diameter of normal human coronary arteries. Influence of age, sex, anatomic variation and left ventricular hypertrophy or dilatation. Circulation 1992; 86(1):232-46.