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

IMRAN ELLAHI SOOMRO¹, MUHAMMAD ASLAM², MUHAMMAD AMIN², AFTAB AHMED³, MUHAMMAD HASSAN BUTT⁵, MUHAMMAD HASHIM⁶
¹Associate professor Cardiology, Peoples University of Medical and Health Sciences for women Nawabshah Pakistan
²Assistant Professor Cardiology, National Institute of Cardiovascular Diseases Nawabshah Pakistan
³Consultant Cardiologist, Tabba Heart Institute Karachi Pakistan
⁴Assistant Professor Cardiology, National Institute of Cardiovascular Diseases Sukkur Pakistan
⁵Assistant Professor Cardiology, Bolan medical College/ Sardanen Provincial Hospital Quetta Pakistan
Corresponding author: Imran Ellahi Soomro, Email: imranellahi7@yahoo.com

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 1).
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.

**FIGURE I: Gender Distribution of the Study Participants**

![Gender Distribution](image)

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

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Females (mean)</th>
<th>SD</th>
<th>Males (mean)</th>
<th>SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>54.9 ±8.3</td>
<td>58.7 ±9.1</td>
<td>0.002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI (Kg/m²)</td>
<td>28.1 ±2.1</td>
<td>26.8 ±2.3</td>
<td>0.020</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BSA (m²)</td>
<td>1.73 ±0.02</td>
<td>1.79 ±0.07</td>
<td>0.007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum Creatinine (mg/dl)</td>
<td>0.97 ±0.09</td>
<td>0.87 ±0.21</td>
<td>0.673</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic Blood Pressure (mmHg)</td>
<td>139.5 ±14.2</td>
<td>138.1 ±12.1</td>
<td>0.456</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diastolic Blood Pressure (mmHg)</td>
<td>81.3 ±7.9</td>
<td>77.7 ±9.8</td>
<td>0.405</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse/minute</td>
<td>79.9 ±8.2</td>
<td>76.8 ±8.34</td>
<td>0.044</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 DDCx 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**

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

**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 may have influenced the results. The morphology of coronary arteries is shown to vary greatly.[10] Numerous 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 DDCx 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 were 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 DDCx 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**

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