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# ASSOCIATION OF WAIST-HIP RATIO WITH SEVERE CORONARY ARTERY DISEASE IN PATIENTS UNDERGOING CORONARY ANGIOGRAPHY IN A TERTIARY CARE HOSPITAL

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**ABSTRACT:**

**BACKGROUND:** *Association of increased waist-hip ratio with severe coronary artery disease has not been determined among our local population. As changing lifestyles have affected anthropometric measurements of population, these associations need to be addressed.*

**AIMS & OBJECTIVE:** *Objectives were to determine the association of increased waist-hip ratio with the severity of coronary artery disease.*

**MATERIAL & METHODS:** *Total of 360 patients of male population were enrolled in the study.180 male cases having severe coronary artery disease (stenosis of > 50% in a major epicardial coronary artery) were taken and increased waist-hip ratio was determined. It was assessed at the time of inclusion into study. Similarly, 180 male controls were taken from same population. A waist-hip ratio of more than 0.95 was taken as increased waist-hip ratio. Odds ratio was calculated to determine the association of increased waist hip ratio with severe coronary artery disease.*

**RESULTS:** *In our sampled population, when we cross tabulated cases and controls with waist to hip ratio above 0.95, we came up with an odd ratio (OR) of 3.49 at p value of 0.028 (significant). It showed that Waist/Hip ratio > 0.95 had not equally distributed among cases and controls. There was significant effect of being smoker but no effect of being obese and family history of coronary artery disease on this association.*

**CONCLUSION:** *It is concluded that in our sampled population we reject the null hypothesis that there is no association of increased waist-hip ratio with severe coronary artery disease and accept the alternate hypothesis that there is an association found between Waist/Hip ratio > 0.95, as odds ratio came out 3.5 with P value=0.02 (Significant).*

**KEY WORDS:** *Risk stratification for coronary artery disease, severe coronary artery disease, Myocardial infarction, Waist/Hip ratio > 0.95, ST Elevation myocardial infarction.*

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## INTRODUCTION

Cardiovascular diseases (CVDs) are the leading killer globally causing about 30% of all the deaths worldwide with about 45% of deaths occurring due to coronary artery disease (CAD). The disease burden is even higher in the People of Indo-Asian origin and it is expected to raise more than double over the next 20 years [1]. This burden in South Asians extends beyond regional concerns, as mortality and morbidity remain higher in even immigrant South Asians living in western regions as compared to the native western populations. Thus an information regarding the determinants of myocardial infarction (MI) is very important to reduce the disease burden[2].

Obesity is a well-known factor associated with CAD. Various methods for determining obesity include anthropometric measures such as body mass index (BMI), waist circumference, waist-hip ratio, neck circumference and subcutaneous fat layer thickness with body mass index as the most widely used method of measuring obesity. However, BMI is not a sensitive measure of obesity. Studies have shown that BMI is not associated with mortality in patients with CAD whereas waist-hip ratio are better indicator of visceral obesity and coronary artery disease as compared to BMI[3]. Recent research has showed that waist hip ratio is also independent predictors of severity of CAD. The results of this study showed that waist-hip ratio > 0.95 was present in 83.2% of the cases of severe CAD as compared to 71.9% of the controls, however, the study concluded that no anthropometric measurement is an independent predictor of CAD[4].

The rationale of this study is to determine the association of increased waist-hip ratio with severe CAD in patients undergoing coronary angiography. Considering the higher burden of disease in Pakistan as compared to the western countries, it becomes highly important to study the determinants of this disease for its control and management. However, majority of the studies conducted regarding relationship of obesity with CAD are based on BMI which is a poor predictor of visceral obesity as compared to waist-hip ratio[5]. Moreover, limited and inconsistent data is available internationally about association of hip-waist ratio with severe CAD. Therefore, this study will generate further evidence regarding this association based on local data where the prevalence of obesity and CAD is much higher as compared to the western countries[6]. Furthermore; this association will also serve as a predictive marker for the severity of coronary disease and is based on simple anthropometric measurement which can be done easily. This will give an idea to the clinicians regarding the severity of the disease and timely intervention for secondary prevention. This will help in decreasing the disease burden as well as the financial burden of diagnostic and management services of CAD on the health system of a resource limited country like Pakistan.

## OPERATIONAL DEFINITION:

Increased waist-hip ratio (exposure variable) Waist circumference was measured at the midpoint between the inferior costal margin and upper iliac crest with the subject standing at the end of expiration in centimeter. Hip circumference was obtained at the level of femoral trochanters with both legs closed with an inelastic measuring tape with a precision of 1 millimeter. Two readings were obtained for each measurement and mean of two readings was taken as final reading. Waist-hip ratio was calculated by dividing the final reading of waist circumference in cm by final reading of hip circumference in cm. A waist-hip ratio of more than 0.95 was taken as increased waist-hip ratio. It was assessed at the time of inclusion into study.

Severe coronary artery disease (outcome variable)

A patient was defined as having severe

coronary artery disease if he had stenosis of > 50% in a major epicardial coronary artery i.e. left anterior descendent, circumflex or right coronary artery or their branches with at least 2.5 mm of diameter determined by diagnostic coronary angiography. It was done at the time of inclusion into study.

**MATERIALS & METHODS:**

This case control study was conducted at the Department of cardiovascular medicine and interventional Cardiology, Allama Iqbal Medical College, Jinnah Hospital, Lahore for a period of six months from 13th December, 2023 to 12th June, 2024 through Non-probability consecutive/ purposive sampling.

**SAMPLE SIZE:**

Sample size of 360 subjects: 180 cases and 180 controls was calculated with 80% power of study, 5% level of significance and taking percentage of increased waist-hip ratio in 83.2% of the cases of severe coronary artery disease as compared to 71.9% of the controls.

**INCLUSION CRITERIA:**

- Male patients
- Age 20-45 years
- H/o chest pain on exertion (i.e. climbing >10 stairs) for at least one month.
- Patients with severe CAD determined by diagnostic coronary angiography as per operational definition.

**EXCLUSION CRITERIA:**

- Both cases and controls having following characteristics will be excluded:
- Patients already diagnosed as having diabetes and hypertension. (Determined by history and medical record)
- Patients with previous coronary artery revascularization by percutaneous or surgical intervention (determined by history)
- Patients with dilated or hypertrophic cardio-myopathy determined by echocardiography.
- Patients with chronic renal disease [determined by history, medical record or having evidence of chronic renal disease on serum urea (>20mg/dl), serum creatinine (>1.2mg/dl) and ultrasonography] and hepatic cirrhosis (determined by history, medical record and evidence of coarse shrunken liver on ultrasonography)
- Patients with previous or current cancer (determined by history and medical records)
- Patients with pelvic surgery or psychiatric disease (determined by history and medical records )
- Patients not willing to participate in the study.

**DATA COLLECTION PROCEDURE:**

A total of 180 subjects with severe CAD were taken as cases (as per operational definition) while 180 subjects were taken as controls. Information regarding all the study variables was recorded in a structured proforma. All cases and controls underwent waist hip ratio measurement with the help of an inelastic measuring tape with one millimeter precision by the researcher himself. The measurements were noted in the proforma and confidentiality of the data was ensured. Increased waist hip ratio was recorded as per operational definition.

**DATA ANALYSIS PROCEDURE:**

Data was entered and analyzed using SPSS version 24.0. Quantitative variable i.e. age was summarized as mean and standard deviation. Qualitative variables i.e. increased waist-hip ratio was presented as frequency tables and percentages. In order to adjust the effect of smoking, BMI and family history of disease data was stratified. Odds ratio was calculated to determine the association of increased waist hip ratio with severe coronary artery disease. Odds ratio of > 2 was taken as significant. Data was stratified for age, BMI, smoking and family history of coronary heart disease to deal with effect modifiers. Post stratification chi-square test was applied. P-value ≤0.05 was considered as significant.

**RESULTS:**

In our study population 360 patients were included with mean age of 41.62 ± 2.749 ranged from 35 to 45 years of age. (Table I). 135 patients (37.5%) in our study population were less than 40 years of age whereas 225 patients (62.5%) were either 40 years or more in age. Patients of our study population (n=360) were equally distributed into cases and controls. (Table II). 305 patients (84.7%) had waist to hips ratio above 0.95. (Table III). Mass index

**Table I: Frequency distribution of sampled population by age groups.**

| | | Frequency | Percent |
|---|---|---|---|
| Valid | Below 40 Years | 135 | 37.5 |
| | 40 Years & above | 225 | 62.5 |
| | Total | 360 | 100.0 |

**Table II : Frequency distribution of sampled population by Group**

| | | Frequency | Percent |
|---|---|---|---|
| Valid | Case | 180 | 50.0 |
| | Control | 180 | 50.0 |
| | Total | 360 | 100.0 |

**Table III: Frequency distribution of sampled population by Waist/Hip ratio > 0.95**

| | | Frequency | Percent |
|---|---|---|---|
| Valid | Yes | 305 | 84.7 |
| | No | 55 | 15.3 |
| | Total | 360 | 100.0 |

**Table IV: Frequency distribution of sampled population by Body mass index >24.9kg/m2**

| | | Frequency | Percent |
|---|---|---|---|
| Valid | Yes | 305 | 84.7 |
| | No | 55 | 15.3 |
| | Total | 360 | 100.0 |

**Table V: Cross tabulation between Group & Waist/Hip ratio > 0.95**

| | | | Waist/Hip ratio > 0.95 | | Total |
|---|---|---|---|---|---|
| | | | Yes | No | |
| Group | Case | Count | 160 | 20 | 180 |
| | | % within Group | 88.9% | 11.1% | 100.0% |
| | Control | Count | 145 | 35 | 180 |
| | | % within Group | 80.6% | 19.4% | 100.0% |
| Total | | Count | 305 | 55 | 360 |
| | | % within Group | 84.7% | 15.3% | 100.0% |
| P value=0.02 (Significant) | | | Odds Ratio= 3.496 | | |

**Table VI: Age groups stratification of crosstab between Group & Waist/Hip ratio > 0.95**

| Age groups | | | | Waist/Hip ratio > 0.95 | | Total |
|---|---|---|---|---|---|---|
| | | | | Yes | No | |
| Below 40 Years | Group | Case | Count | 48 | 5 | 53 |
| | | | % within Group | 90.6% | 9.4% | 100.0% |
| | | Control | Count | 67 | 15 | 82 |
| | | | % within Group | 81.7% | 18.3% | 100.0% |
| | Total | | Count | 115 | 20 | 135 |
| | | | % within Group | 85.2% | 14.8% | 100.0% |
| OR=2.149, p value= 0.15 (non-significant) | | | | | | |

| Table VII: Weight groups stratification of crosstab between Groups & Waist/Hip ratio > 0.95 | | | | | |
|---|---|---|---|---|---|
| Body mass index >24.9kg/m2 | | | Waist/Hip ratio > 0.95 | | Total |
| | | | Yes | No | |
| Group | Case | Count | 160 | 0 | 160 |
| | | % within Group | 100.0% | 0 | 100.0% |
| | Control | Count | 145 | 0 | 145 |
| | | % within Group | 100.0% | 0 | 100.0% |
| Total | | Count | 305 | 0 | 305 |
| | | % within Group | 100.0% | 0 | 100.0% |

was above 24.9 kg/m$^2$. (Table IV)

When we cross tabulated our study group (case & control) with waist to hip ratio above 0.95, we came up with an odd ratio (OR) of 3.49 at p value of 0.028 (significant). It showed that Waist/Hip ratio > 0.95 had not equally distributed among cases and controls. (Table V)

When we stratified the cross tabulated group and Waist/Hip ratio > 0.95 with age group, in cases and control group of patients with age below 40 years showed up non-significant results (p=0.157), similar results were seen in cases and controls of age group above 40 years (p=0.078 & OR=1.91). (Table VI)

When we stratified the cross tabulation data of groups & Waist/Hip ratio > 0.95 for obesity, 160 patients with Body mass index >24.9kg/m2 found in case group with Waist/Hip ratio > 0.95 and 145 patients in control with Body mass index >24.9kg/m2 had Waist/Hip ratio > 0.95. (Table VII)

**DISCUSSION:**

Cardiovascular diseases (CVDs) are indeed a significant global health challenge, accounting for a substantial portion of mortality worldwide. They encompass a range of disorders affecting the heart and blood vessels, including coronary artery disease, heart failure, arrhythmias, and others. CAD is one of the most prevalent forms of CVD and is primarily caused by the accumulation of atherosclerotic plaques in the coronary arteries, which supply blood to the heart muscle. This can lead to serious outcomes such as heart attacks and other cardiovascular events [7].

The disease burden is even higher in subcontinent and it is expected to raise more than double over the next 20 years [8]. This burden in South Asians extends beyond regional concerns, as mortality and morbidity remain higher in even immigrant South Asians living in western regions as compared to the native western populations. Thus an information regarding the determinants of myocardial infarction is very important to reduce the disease burden[9].

Waist-hip ratio is considered a better indicator of visceral obesity and coronary artery disease as compared to body mass index[10]. In our study, there is an association found between Waist/Hip ratio > 0.95, as odds ratio came out 3.5 with P value=0.02 (Significant). When we cross tabulated our study group (case & control) with waist to hip ratio above 0.95, it showed that Waist/Hip ratio > 0.95 had not been equally distributed among cases and controls.

In our study, 88.9% of cases with severe coronary artery disease and 80.6% of controls had Waist/Hip ratio > 0.95. our results matches with recent research has showed that waist hip ratio are also independent predictors of severity of coronary artery disease.8 The results of this study showed that waist-hip ratio > 0.95 was present in 83.2% of the cases of (1.4-10.1)[11].

Our results concluded that no anthropometric measurement is an independent predictor of coronary artery disease the difference may be secondary to population sampled. For better conflict resolution, a cohort study is needed [12]. When we stratified the cross tabulated data of groups & Waist/Hip ratio > 0.95 with current smokers, 147 patients that were currently smoking found in case group with

Waist/Hip ratio > 0.95 and 134 patients in control that were currently smoking had Waist/Hip ratio > 0.95. Results were statistically significant (p=0.038). It implies that there was effect of smoking on development of severe coronary artery disease[13].

When we stratified the cross tabulation data of groups & Waist/Hip ratio > 0.95 with family history of coronary artery disease, 128 patients with family history of disease found in case group with Waist/Hip ratio > 0.95 and 124 patients in control with family history had Waist/Hip ratio > 0.95. Results were statistically non-significant (p=0.078) [14].

In our study, 305 patients (84.7%) had waist to hips ratio above 0.95. 303 patients (84.2%) in our sampled population had family history of disease. 333 patients (92.5%) were currently smokers. 305 patients (84.7%) had body mass index was above 24.9 kg/m2. All the indices are alarming. Considering the higher burden of disease in Pakistan as compared to the western countries[15] it becomes highly important to control these determinants of CAD.

**CONCLUSION:**

It is concluded that in our sampled population we reject the null hypothesis that there is no association of increased waist-hip ratio with severe coronary artery disease and accept the alternate hypothesis that there is an association found between Waist/Hip ratio > 0.95, as odds ratio came out 3.5 with P value=0.02 (Significant).

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