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ORIGINAL ARTICLE

Association of Waist and Hip Ratio with the Angiographicc Severity of Coronary Artery Disease in Patients with Non ST Segment Elevation Myocardial Infarction

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ABSTRACT

Background: Coronary artery disease and obesity cardiomyopathy, and cardiac autonomic neuropathy are the most prevalent types of cardiac involvement in the comorbid. Obesity has a two- to fourfold greater risk of developing coronary artery disease. Stroke and other cerebrovascular occurrences fare poorly for those with obesity and diabetes. Hospital, autopsy, epidemiological, longitudinal research, and other studies have all demonstrated the increasing prevalence of cardiomyopathy in diabetes and obese individuals

Objective: the objective of the study is to association of waist and hip ratio with the angiographic severity of coronary artery disease in patients with non-ST segment elevation myocardial infarction

Study Design: Cross sectional observational study

Study Setting: This study was conducted in the department of Interventional Cardiology, National Institute of Cardiovascular Diseases (NICVD), Karachi from Ist August 2022 to 31st January 2023.

Methodology: Total 120 subjects were enrolled in the study and divided in to two groups. Group I consisted of 60 patients with normal WHR, and group II consisted of 60 patients with elevated WHR. The history and anthropometric measurements were noted using a pre-designed structured form, including demographic data and a profile of potential risk factors. Three universal criteria for diagnosing myocardial infarction were used to confirm the presence of non-ST segment elevation myocardial infarction. Each participant's signed permission was obtained before any data was collected. The patient's waist and hip circumferences were measured the day before the CAG. At least two cardiologists engaged per patient's therapy or the clinical context while evaluating the angiogram results. Visual estimation (in at least two orthogonal views) was used to estimate the vessel and Gensini scores to determine the degree of coronary artery disease on angiograms. The statistical analysis was done by using SPSS version 20.

Results: Patients in Group II had a considerably higher mean body mass index and anthropometric status than those in Group I. The average WHR of the participants in the study is listed in order of increasing vascular involvement. For those with normal angiogram results, the average WHR was 0.98. There was a statistically significant difference (p<0.01) in the mean WHRs of those with single-vessel disease and the value of mean is gradually increased in scoring 1, 2 and 3. The WHR positively correlated with the severity of CAD as measured by vessel score (r=0.45). In addition, a positive connection (r=0.63) between WHR and CAD severity, as measured by the Gensini score. Multivariate logistic regression analysis of odds ratio (OR) for subject characteristics likely to cause coronary artery disease severity.

Practical implication: In addition, there is only one local study, which provides scant information, and worldwide data is scant and conflicting about the relationship of the ratio of waist to hip with severe coronary artery disease (CAD). The incidence of obesity and coronary artery disease in Pakistan is much higher than in Western countries; thus, this study will offer more information regarding the relationship based on local data.

Conclusion: The current study found that in individuals with non-ST-segment elevation myocardial infarction, increasing WHR was substantially correlated with the angiographic severity of coronary artery disease

Keyword: WHR, BMI, Waist circumference, Cardiovascular disease

INTRODUCTION

Coronary artery disease (CAD) and obesity cardiomyopathy, and cardiac autonomic neuropathy are the most prevalent types of cardiac involvement in the comorbid. Obesity has a two- to fourfold greater risk of developing and dying from CAD. Stroke and other cerebrovascular disease (CVD) occurrences fare poorly. This problem is not confined to South Asia; even among South Asian immigrants in the West, death and morbidity rates are greater than among the local populations. Since the prevalence of obesity and coronary artery disease is much higher in developing countries than in developed ones, this study will provide additional evidence regarding this association based on local data.[1] Coronary artery disease (CAD) is the leading cause of mortality in industrialized nations, accounting for around 7.2 million fatalities annually, or 12% of all deaths globally. The prevalence of coronary heart disease (CHD) has skyrocketed in emerging nations as a result of rapid urbanization, changes in lifestyle, and economic expansion.[2] The risk of developing coronary artery disease is increased in CAD patients.[3] Hospital, autopsy, epidemiological, longitudinal research, and other studies have all demonstrated the increasing prevalence of CAD in diabetes individuals.[4, 5] Postmortem investigations, angiographic and IVUS-based research, and studies using multi-slice coronary computed angiography have all documented an association between DM and more widespread CAD.[6]

Body mass index (BMI), waist circumference (WC), waist-hip ratio (WHR), neck circumference (NC), and subcutaneous fat layer thickness (SFL) are only a few of the anthropometric measurements used to diagnose obesity. However, BMI is an insensitive indicator of overweight status. It has been demonstrated via research that the waist-hip ratio is a more accurate indication of visceral obesity and coronary artery disease than the body mass index is.[7] Ultrasound-based measures of obesity are not superior to anthropometric indices for predicting coronary artery disease. The waist-to-hip ratio is an additional independent predictor of coronary artery disease severity. Among those with severe coronary artery disease, 83.2% had a waist-hip ratio > 0.95, while only 71.9% of controls did, yielding an odds ratio of 3.7 (1.4-10.1).[8] The mean waist-hip ratio was 0.960 in moderate to severe CAD and 0.880 in normal to mild CAD, according to research. Body mass index is a poor predictor of visceral obesity compared to the waist-hip ratio, which has been the focus of most research looking at the association between obesity and coronary artery disease. The link between a high waist-to-hip ratio and severe coronary artery disease is not well studied.

The gold standard for diagnosing and characterizing CAD, coronary angiography, also provides therapy choices and establishes prognosis.[9] Predicting procedural outcomes and complications following PCI is further aided by the heterogeneity in the composition, distribution, and location of atherosclerotic plaque within the coronary arteries. The success and complication rates of procedures may be linked to certain lesion features[10] Therefore, the objective of the study is to association of waist and hip ratio with the angiographic severity of coronary artery disease in patients with non-ST segment elevation myocardial infarction

METHODS

Study Design and Setting: After taking approval from ERB of hospital this cross-sectional observational research was conducted at department of Interventional Cardiology, National Institute of Cardiovascular Diseases (NICVD), Karachi from Ist August 2022 to 31st January 2023. Patients hospitalized in the cardiology ward with NSTEMI who met the study's inclusion and exclusion criteria were evaluated for participation. One hundred people were chosen at random to participate in the study. Group I consisted of 60 patients with normal WHR, and group II consisted of 60 patients with elevated WHR.

Sample Size: Sample size calculation was done to compare proportions where the confidence interval was equal to 95 % with a 5% significance level, taking 80% power of the study. The 120 total sample size was calculated. We divided equal no of patients in both the groups.

Inclusion and Exclusion criteria: Participants willing to enroll in the study were included, aged 25-70 years, males, and females. Study participants who have any severe co-morbid conditions such as liver disease, thyroid disorder, renal disease, malabsorption were excluded from the study.[21,22]

Data Collection: The history and anthropometric measurements were noted using a pre-designed structured form, including demographic data and a profile of potential risk factors. Three universal criteria for diagnosing Myocardial Infarction were used to confirm the presence of NSTEMI. Each participant's signed permission was obtained before any data was collected. The patient's waist and hip circumferences were measured the day before the CAG. Waist circumference was measured using stretch-resistant tape after a normal expiration where the lower edge of the least perceptible rib meets the top of the iliac crest. The buttocks' widest point was where the hip circumference tape was placed to get an accurate reading. The condition of CAG has been studied as a starting point. The coronary angiography was performed by cardiologists with extensive expertise who conducted all radial and femoral procedures. Two cardiologists needed to know the patient's therapy or the clinical context while evaluating the angiogram results. Visual estimation (in at least two orthogonal views) was used to estimate the vessel and Gensini scores to determine the degree of coronary artery disease on angiograms.

Statistical Analysis: SPSS version 25 was used for the data analysis. (An application for social science statistics) Mean and standard deviation was used to represent continuous data, whereas percentages were used to represent dichotomous data. The Chi-square (X2) test, Fisher's exact test, and the analysis of variance (ANOVA) were employed to compare continuous variables, while the unpaired t-test was used for categorical data. P = 0.05 and a 95% confidence interval were used to determine if the findings were statistically significant. Logistic regression analysis, the Spearman rank correlation coefficient test, and the Pearson correlation coefficient test were utilized where suitable.

RESULTS

Patients were evenly distributed throughout groups. Therefore, there was no discernible variation in average age or sex. Both groups had a higher percentage of males than females. As shown in Table I, there is a statistically significant age, Ejection Fraction (%), Vessel score, CAD Severity Gensini Score (p<0.05) difference between Group I and II. There was no statistically significant difference in the distribution of patients between the two groups gender and risk factors.

Table 1: Distribution of demographic, ejection fraction and scoring of both groups.

Variables		Group		P Value
		Group I n (%)	Group II n (%)	
Gender	Female	16 (26.7)	8 (13.3)	0.068
	Male	44 (73.3)	52 (86.7)	
Age	<40	24 (40.0)	27 (45.0)	0.018*
	40-49	14 (23.3)	9 (15)	
	50-59	8 (13.3)	19 (31.7)	
	>60	14 (23.3)	5 (8.3)	
Risk Factors	Hypertension	13 (21.7)	9 (15)	0.510
	Diabetes Mellitus	28 (46.7)	36 (60)	
	Dyslipidemia	9 (15)	8 (13.3)	
	Smoking	10 (16.7)	7 (11.7)	
Ejection Fraction	Moderate LV dysfunction	25 (41.7)	8 (13.3)	0.002*
	Mild LV dysfunction	19 (31.7)	26 (43.3)	
	Normal LV function	16 (26.7)	26 (43.3)	
Vessel score	Score 0	18 (30.0)	11 (18.3)	<0.001*
	Score 1	26 (43.3)	0	
	Score 2	13 (21.7)	30 (50.0)	
	Score 3	3 (5.0)	19 (31.7)	
CAD Severity Gensini Score	Moderate to Severe	8 (13.3)	52 (86.7)	<0.001*
	Normal to Mild	52 (86.7)	8 (13.3)	

Patients in Group II had a considerably higher mean body mass index and anthropometric status than those in Group I (Table II).

Table 2: Anthropometric distribution of both groups

Group		Mean	Std. Deviation	P Value
BMI	Group I	21.91	0.85	<0.001
	Group II	27.10	1.19	
Waist circumference	Group I	74.33	2.82	.027
	Group II	96.55	4.00	
Waist Hip Ratio	Group I	0.83	0.02	.016
	Group II	1.24	0.02	

Table III represents the comparison of WHR between the gender based of Group I and II. The table showed the significantly increased value (1.1±0.011, p<0.001) in female of Group II.

Table 3: Comparison of gender based WHR of both groups

Study Group	Waist Hip Ratio		P value
	Male	Female	
	Mean±SD	Mean±SD	
Group I	0.78±0.010	0.81±0.024	<0.001
Group II	1.23±0.021	1.1±0.011	<0.001

The average WHR of the participants in the study is listed in order of increasing vascular involvement in Table IV. For those with normal angiogram results, the average WHR was 0.98. There was a statistically significant difference (p<0.01) in the mean WHRs of those with single-vessel disease and the value of mean is gradually increased in scoring 1, 2 and 3.

Table 4: WHR distribution-based vessel scoring

Waist Hip Ratio						
				95% Confidence Interval for Mean		
Vessel Score	N	Mean	Std. Deviation	Lower Bound	Upper Bound	P value
Score 0	29	.98	.20	.91	1.06	<0.001
Score 1	26	.83	.02	.83	.84	<0.001
Score 2	43	1.12	.19	1.06	1.17	<0.001
Score 3	22	1.18	.14	1.12	1.25	<0.001

Table V displays the patients' mean coronary artery disease (CAD) severity throughout the trial. Group II had a considerably larger proportion of individuals with moderate to severe CAD than Group I (p = 0.05). There was a statistically significant disparity between Group I and Group II on the mean Gensini Score. Patients in Group I were more likely to have noncritical CAD in comparison to patients in Group II.

Table 5: Frequency of CAD severity of both groups.

	CAD Severity		P value
	Moderate to severe	Normal to Mild	
Group I	8 (13.3%)	52(86.7%)	<0.05
Group II	52 (86.7%)	8(13.3%)	<0.05

Table VI shows a statistically significant difference in the mean WHR between the groups with moderate to severe CAD and those with normal to mild CAD. Figure 1 shows that the WHR positively correlated with the severity of CAD as measured by vessel score (r=0.45). In addition, a positive connection (r=0.63) between WHR and CAD severity, as measured by the Gensini score, is seen in Figure 2.

Table 6: Status of CAD severity based on WHR

	CAD Severity	Mean	Std. Deviation	P value
WHR	Moderate to severe	1.18	0.14	.009
	Normal to Mild	0.89	0.14	

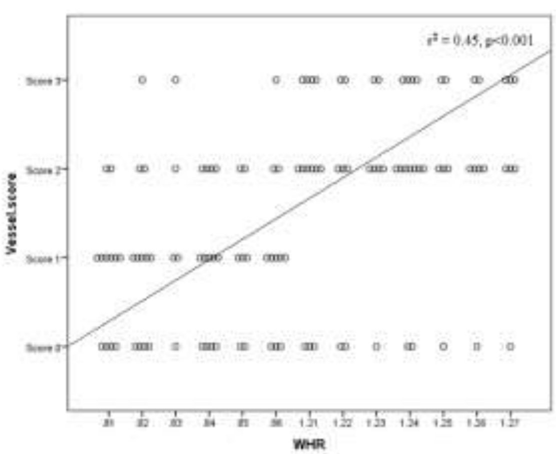

Figure 1: Pearson correlation of WHR and Vessel Score

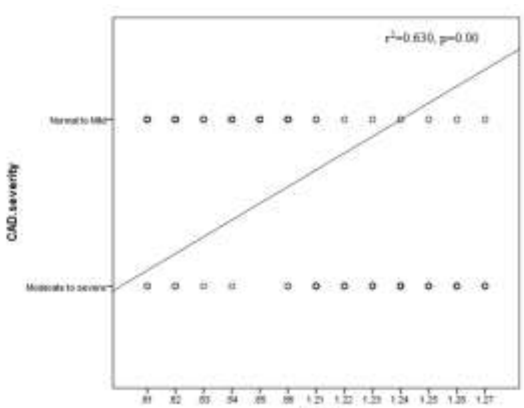

Figure 2: Pearson correlation of WHR and CAD Severity

Multivariate logistic regression analysis of odds ratio (OR) for subject characteristics likely to cause coronary artery disease severity is shown in Table VIII. Significant predictors of severe CAD were an increased waist circumference, higher body mass index, and higher waist-to-hip ratio. Moreover, the waist/Hip ratio >0.90 was associated with an increased risk of metabolic syndrome (odds ratio 1.56, p = 0.028)

Table 8: Regression analysis of CAD severity and anthropometric measurements

Variables	Regression Coefficient (B)	Odd Ratio	Sig.	95 % Confidence Interval for B	
				Lower Bound	Upper Bound
BMI	.125	1.340	.007	.072	.047
Waist circumference	.636	1.456	.005	.013	.026
Waist hip ratio	.992	2.864	.005	1.267	3.365

DISCUSSION

Most people over 60 will be diagnosed with cardiovascular disease (CVD) at some point in their lives. A third and a half of all instances of cardiovascular disease may be attributed to coronary heart disease (CHD). The Wilson Peter demonstrates that 7,733 people without CHD at baseline; their ages ranged from 40 to 94. At age 1340, the lifetime risk was 49% for men and 32% for women. Taking the right precautions may drastically reduce your risk for cardiovascular disease. Smoking, dyslipidemia, hypertension, diabetes, abdominal obesity, psychosocial factors, daily consumption of fruits and vegetables, regular alcohol consumption, and regular physical activity accounted for over 90% of the population-attributable risk of a first MI in the worldwide.[11] Outside of chronological age and gender, most individuals with cardiovascular disease have at least one established or borderline risk factor. Therefore, knowing the causes of myocardial infarction is crucial for lessening the impact of this disease. Hence, CHD is directly linked to the inflammatory process that causes fat accumulation in the body.[12] Body mass index may not best predict visceral obesity and cardiovascular illness, but the waist-to-hip ratio may be.[13] Waist-to-hip ratios greater than 0.95 were not distributed uniformly amongst the ases and controls, as shown by a cross-tabulation of the whole research population. Consistent with Zen et al., our findings are. According to research by Zen et al., the waist-to-hip ratio is an additional independent predictor of coronary artery disease severity.14 Among those with severe coronary artery disease, 85.2% had a waist-hip ratio > 0.95. In comparison, only 74.8% of the controls did,the other showed that no anthropometric parameter is an independent predictor of coronary artery disease, as Chagas et al. suggested, is refuted by our findings.15 The discrepancy could be a byproduct of the chosen demographic for the study. We observed 28 diabetic patients in the case group with a Waist/Hip ratio > 0.95, whereas 134 smoking patients in the control group also had a Waist/Hip ratio > 0.95 when we cross-tabulated the data. The p-value of 0.038 indicates statistical significance. This finding suggests that diabetes contributes to the progression of coronary artery disease. One hundred and twenty-eight (68.0%) patients with a family history of coronary artery disease were found in the case group with a Waist/Hip ratio > 0.95. In comparison, (9.5%) patients in control had a similar value. Due to Pakistan's increased disease burden compared to Western nations 3, addressing these risk factors for coronary artery disease is crucial.16 This research aimed to examine the correlation between WHR and coronary artery disease severity in individuals with NSTEMI. There was a difference in the mean body mass index and anthropometric status between the two groups. Group II had a greater body mass index (BMI) and Waist-hip ratio than Group I (p0.001). The findings were consistent with those of Akcay Murat and Sahin Murat.[17]

More patients in Group II were involved in three vessels than in Group I (p=0.03). This finding was consistent with the findings of Babic Zdravko et al.18 Differences in WHR between groups with and without vessel involvement were statistically significant (p<0.01) when at least one vessel was engaged. According to research by Singh Sandeep et al.5, unusually high WHR was identified in 65% of patients with CAD, whereas 34% of individuals with normal WHR were diagnosed with CAD.19 The patients in Group II showed higher frequecny of those in Group I had moderate to severe CAD. Group II had a considerably larger proportion of individuals with moderate to severe CAD than Group I (p<0.001). Increased WHR was associated with almost double the incidence of CAD compared to normal WHR. Consistent with the present study's finding, Ahmad et al. found that the relative risk of CAD was roughly double in the Group with elevated WHR compared to those with normal WHR[19]

Group, I had a mean Gensini Score of Group II was a statistically significant (p<0.001) disparity between Group I and Group II on the mean Gensini Score. According to a study by Bakhoum et al., the average Genseni score was 85.13 in patients with abdominal obesity compared to 60.446 in patients without abdominal obesity.[20] There was a statistically significant difference (p=0.004) in the mean WHR between the moderate to severe CAD and normal to mild CAD groups. The vessel score for coronary artery disease was positively correlated with WHR. A statistically significant Pearson's rank correlation was found. Coronary artery disease severity, as measured by the Gensini score, was positively correlated with WHR. The results of Pearson's correlation were found to be very significant (p0.001).The severity of coronary artery disease was analyzed using a multivariate logistic regression analysis of odds ratio (OR) for subject characteristics. Multivariate analysis was used to input the factors substantially linked with severe CAD directly. Significant predictors of severe CAD were reported, with ORs of or waist circumference, higher BMI, and elevated WHR, respectively.

CONCLUSION

The current study found that in individuals with non-ST-segment elevation myocardial infarction, increasing WHR was substantially correlated with the angiographic severity of coronary artery disease. The vessel scores and WHR had a very strong positive connection. According to Genseni's score, patients with high degrees of angiographic stenosis had greater WHR levels. Therefore, in patients with acute Non-ST-segment elevation myocardial infarction, abdominal obesity, as demonstrated by increased WHR, may be considered a predictor of the severity of CAD.

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