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Correlation of Waist-To-Hip Ratio with Angiographic Severity by Gensini Score in Non-St Elevation Myocardial Infarction.

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Abstract

Background: Waist-to-hip ratio (WHR) has prognostic significance in acute myocardial infarction. This study aims to determine the correlation between WHR and angiographic severity assessed by the Gensini score in patients with non-ST elevated myocardial infarction (NSTEMI).

Methodology: This descriptive cross-sectional study was conducted in the Cardiology Department of a tertiary care hospital, Lady Reading Hospital, Peshawar. A total of 192 patients were included. Detailed histories and complete physical examinations were performed, and major cardiovascular risk factors such as age, sex, smoking status, diabetes mellitus, and hypertension were recorded. Waist and hip circumferences were measured at the level of the iliac crest and greater trochanter of the femur, respectively, while the patient was in a standing position. The waist-to-hip ratio was calculated based on these measurements.

Results: The mean age of the participants was 49 years ± 6.73. The correlation coefficient ($r = 0.317$) demonstrated a positive correlation between waist-to-hip ratio and angiographic severity assessed by the Gensini score, with a significant p-value of <0.001.

Conclusion: In patients with non-ST elevation myocardial infarction, there is a positive correlation between waist-to-hip ratio and angiographic severity assessed by the Gensini score. These findings suggest that WHR may serve as a useful prognostic indicator in NSTEMI patients.

Keywords

Correlation, Waist-to-Hip Ratio, Gensini Score, Non-ST Elevation Myocardial Infarction.

Introduction

Cardiovascular disease (CVD) has emerged as the leading cause of death and disability worldwide[1]. According to the World Health Organization (WHO), a significant number of global deaths, estimated at 7.4 million, were attributed to heart attacks (myocardial infarctions) out of the 17.5 million deaths caused by CVD in 2012[1]. Alarmingly, cardiovascular deaths accounted for 30 percent of all global deaths, with a majority (80 percent) occurring in low- and middle-income countries[1]. In recent years, research has highlighted the higher mortality rates due to coronary heart disease among South Asian populations when compared to native majority White populations[2,3,4]. This disparity may be due to a higher incidence of coronary disease in South Asians or a worse prognosis once coronary disease has manifested[5]. In Pakistan, cardiovascular disease is a major cause of hospital admissions, accounting for 16.4 percent of all admissions[6].

The development of coronary artery disease (CAD) is closely associated with adiposity, which contributes to the occurrence of hypertension (HTN), diabetes mellitus (DM), and dyslipidemia[7]. Over the past two decades, medical research has shifted our understanding of visceral adiposity from being a mere storage depot to recognizing its role as an endocrine organ involved in the pathogenesis of type 2 diabetes mellitus (T2DM) and CAD[8,9]. Previous studies have established the association between abdominal fat, as a measure of central obesity, and the development of CAD[10-12]. Recent research has also focused on the paracrine effects of adipose tissue, which can complicate CAD by influencing triglyceridemia, insulinemia, and uric acid levels in the body[13]. Indian studies have demonstrated the correlation between neck circumference and angiographic severity[14,15], while a study conducted in South America revealed a correlation between waist-to-hip ratio (WHR) and angiographic severity of CAD using the Gensini score (with an r-value of 0.201)[16]. Several scoring systems, such as the SYNTAX score[17-19] and Gensini score[20,21], are utilized in cardiovascular medicine to assess the severity of CAD angiographically.

The motivation for this research stemmed from the scarcity of data on the correlation between WHR and the severity of CAD in the sub-continental population. Given the differences in dietary habits, ethnicity, physical activities, and CAD incidence between our region and Western societies, it is essential to investigate this correlation and provide the latest and most updated information on these variables. Once the correlation is established, we can identify high-risk populations among patients with acute non-ST elevated myocardial infarction (NSTEMI) simply by measuring the WHR. This would enable the adoption of an early invasive approach, such as revascularization through percutaneous coronary intervention (stenting). The study results will be shared with local cardiologists, and recommendations will be made for early intervention in these patients.

Methodology

After obtaining approval from the hospital's Ethical and Research Committee, this study was conducted at the Cardiology Emergency Department of Lady Reading Hospital, Peshawar, from 5th January 2019 to 5th July 2019.

The study enrolled patients of both genders, aged between 35 years and 60 years, who presented with non-ST elevated myocardial infarction. Patients with specific ECG findings such as ST elevation, pathologic Q waves, LBBB, paced rhythm, and a history of acute coronary syndrome, angioplasty, bypass surgery, congenital heart disease, cardiomyopathy, heart failure, valvular or pericardial disease were excluded from the research. Additionally, patients who refused to undergo coronary angiography were not included.

After obtaining informed consent, the enrolled patients were admitted to the Cardiology Department. Detailed medical histories were obtained, and routine physical examinations were conducted for each participant. Major cardiovascular risk factors including age, sex,

smoking status, diabetes mellitus, and hypertension were assessed. Waist and hip circumferences were measured using an inelastic tape at the level of the iliac crest and greater trochanter of the femur, respectively. The waist-to-hip ratio (WHR) was then calculated.

Baseline investigations, including ECG (Cardiofax), and venous blood samples for cardiac enzymes, lipid profile, and blood sugar, were obtained upon admission. Coronary angiography was performed for each patient in the Cath Lab using a Toshiba machine, under the supervision of experienced cardiologists. The angiographic images were reviewed by the cardiologists, and the severity of coronary artery disease (CAD) was assessed using the Gensini score.

All the collected information was recorded in a predefined proforma, following strict inclusion and exclusion criteria to minimize bias. The data were stored and analyzed using SPSS version 22 for Windows. Continuous variables such as age, WHR, and Gensini scores were presented as mean and standard deviation, while categorical variables such as gender, smoking, diabetes mellitus, hypertension, positive family history of CAD, and physical activity were presented as frequencies and percentages. The Pearson correlation test was applied to assess the correlation between the waist-to-hip ratio and the angiographic severity assessed by the Gensini score, with the calculation of the correlation coefficient (r-value). A p-value of ≤0.05 was considered statistically significant. Effect modifiers such as age, gender, smoking, diabetes mellitus, hypertension, positive family history, and physical activity were controlled through stratification. Post-stratification Pearson correlation was applied, and a p-value of ≤0.05 was considered significant. The results were presented in the form of tables, graphs, and charts.

Results

A total of 192 patients were included in our study, with 19 patients (10%) falling in the age range of 35-40 years, 65 patients (34%) in the age range of 41-50 years, and 108 patients (56%) in the age range of 51-60 years. The mean age of the participants was 49 years ± 6.73. Among the study population, 127 patients (66%) were male and 65 patients (34%) were female (Table 1).

Table 1: Distribution of age and gender of the patients

Parameter	Age (years)	n (%)
Age	35- 40	19 (10)
	41-50	65 (34)
	51-60	108 (56)
Gender	Male	127 (66)
	Female	65 (34)

Regarding smoking status, 136 patients (71%) were smokers, while 56 patients (29%) were nonsmokers. In terms of diabetes, 121 patients (63%) had diabetes, and 71 patients (37%) were nondiabetic. Hypertension was observed in 140 patients (73%), while 52 patients (27%) were non-hypertensive (Table 2). A positive family history of CAD was reported in 44 patients (23%), while 148 patients (77%) had a negative family history. Furthermore, 111 patients (58%) engaged in physical activity, while 81 patients (42%) did not participate in any physical activity (Table 2).

Table 2: Frequency of different variable in study sample

Parameter		n (%)
Hypertension	**Yes**	140 (73)
	No	52 (27)
Diabetes Mellitus	**Yes**	121 (63)
	No	71 (37)
Smoking	**Yes**	136 (71)
	No	56 (29)
Family history	**Yes**	44 (23)
	No	148 (77)
Physical activity	**Yes**	111 (58)
	No	81 (42)

We analyzed the correlation between waist-to-hip ratio (WHR) and angiographic severity measured by the Gensini score. The mean waist-to-hip ratio was 0.97 ± 0.021, and the mean Gensini score was 23.7 ± 19.34. The correlation coefficient (r) of 0.317 indicated a positive correlation between waist-to-hip ratio and angiographic severity by Gensini score, with a significant p-value of <0.001 (Table 3).

Table 3: Correlation of Waist-To-Hip Ratio with Angiographic Severity by Gensini Score

	Waist To Hip Ratio	Gensini Score	R-Value	P-Value
Mean ± SD	0.97 ±0.021	23.7±9.34	0.317	<0.001

Stratification of the correlation between waist-to-hip ratio and angiographic severity by Gensini score was performed based on age, gender, smoking, diabetes mellitus (DM), hypertension (HTN), positive family history, and physical activity. The results of the stratification analysis are presented in Table 4.

Table 4: Correlation of Waist-To-Hip Ratio with Angiographic Severity by Gensini Score with respect to Age, Gender, Smoking, Diabetes, Hypertension, Family History and Physical Activity

Parameter	Sub-Division of Parameter	Waist To Hip Ratio (Mean ± SD)	Gensini Score (Mean ± SD)	R-Value	P-Value
Age Group	35-40 years	0.91 ± 0.025	21.34±9.7	0.326	<0.001
	41-50 years	0.94 ± 0.022	24.7 ± 8.3	0.341	
	51-60 years	0.95 ± 0.029	23 ± 10.6	0.338	
Gender	Male	0.95 ± 0.019	22.9 ±10.7	0.322	<0.001
	Female	0.96 ± 0.020	24.7 ± 11	0.357	
Smoking	Smoker	0.95 ± 0.024	24.7 ± 10.9	0.325	<0.001
	Non smoker	0.96 ± 0.023	22.5 ± 8.9	0.344	
Diabetes Mellitus	Diabetic	0.99 ± 0.025	24.7 ±10.4	0.321	<0.001
	Non-diabetic	0.955 ± 0.02	19.9 ± 9.4	0.338	
Hypertension	Hypertensive	0.99 ± 0.023	25 ± 9.7	0.327	<0.001
	Non hypertensive	0.97 ± 0.02	21.5 ± 8.4	0.348	

Family History	Yes	0.96 ± 0.023	22.7±10.34	0.323	<0.001
	No	0.98 ± 0.022	22.2 ± 9.4	0.356	
Physical Activity	Yes	0.98 ± 0.02	23.5 ± 10.3	0.331	<0.001
	No	0.96±0.024	22.7 ± 9.5	0.348	

Discussion

Cardiovascular disease (CVD) remains the leading cause of death and disability worldwide[1]. According to the World Health Organization (WHO), heart attacks accounted for 7.4 million deaths out of 17.5 million global CVD deaths in 2012[1]. These cardiovascular deaths comprised 30 percent of all global deaths, with the majority occurring in low- and middle-income countries[1].

In our study, the mean age of the participants was 49 years ± 6.73, with 66 percent of patients being male and 34 percent being female. We observed a positive correlation between waist-to-hip ratio (WHR) and angiographic severity measured by the Gensini score, with a correlation coefficient (r) of 0.317. This finding suggests that higher WHR values are associated with increased angiographic severity of coronary artery disease (CAD).

Our results align with the findings of previous studies. Hossain et al.[22] reported a significant positive correlation between WHR and vessel score (r=0.62, p=0.003) and found that patients with increased WHR had a higher prevalence of moderate to severe CAD. Parsa et al.[23] also demonstrated a statistically significant difference in WHR between patients with moderate to severe CAD and those with normal to mild CAD.

Furthermore, Bakhoum et al.[24] found a higher Gensini score in patients with abdominal obesity, as indicated by increased waist circumference, compared to the normal population. These studies, along with our findings, support the association between WHR and angiographic severity of CAD.

However, it is important to note that our study has some limitations. One major limitation is the relatively small sample size. Conducting larger studies with a standardized study population, considering factors such as sex and age, and incorporating long-term follow-up would provide more robust evidence regarding the relationship between waist-to-hip ratio and angiographic severity measured by the Gensini score in patients presenting with non-ST elevation myocardial infarction (NSTEMI).

Conclusion

In conclusion, our study highlights a positive correlation between waist-to-hip ratio and angiographic severity of CAD measured by the Gensini score in patients with NSTEMI. These findings emphasize the potential role of WHR as a non-invasive marker for assessing the severity of CAD. Further research with larger sample sizes and long-term follow-up is warranted to validate our results and explore the clinical implications of WHR in risk stratification and treatment decision-making for patients with NSTEMI.

Limitations

Despite the valuable findings of our study, several limitations should be acknowledged. First, the sample size of our study was relatively small, which may limit the generalizability of the results. Conducting larger-scale studies with a more diverse population would provide more robust evidence. Second, our study focused on patients with non-ST elevation myocardial infarction (NSTEMI), and therefore, the findings may not be applicable to other patient populations or different types of coronary artery disease. Lastly, the cross-sectional nature of our study design limits our ability to establish causality and determine the long-term prognostic implications of the observed correlations. Longitudinal studies with extended follow-up periods are needed to address these limitations and further explore the clinical significance of waist-to-hip ratio in CAD assessment.

Recommendations

Based on the results and limitations of our study, several recommendations can be made for future research. Firstly, conducting larger-scale studies with a more diverse and representative population would enhance the generalizability of the findings. Additionally, incorporating a longitudinal design and long-term follow-up would provide valuable insights into the prognostic implications of waist-to-hip ratio in CAD. Furthermore, exploring the role of waist-to-hip ratio in other subsets of patients with different types of coronary artery disease could help elucidate its clinical utility as a risk stratification tool. Lastly, investigating the impact of interventions targeting waist-to-hip ratio modification on CAD outcomes could provide valuable information for preventive strategies and personalized treatment approaches.

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References

1) Mendis S, Puska P, Norrving B. Global Atlas on Cardiovascular Disease Prevention and Control. World Health Organization; 2015.
2) Harding S, Rosato M, Teyhan A. Trends for coronary heart disease and stroke mortality among migrants in England and Wales, 1979–2003: slow declines notable for some groups. Heart. 2008;94(4):463–470.
3) Palaniappan L, Wang Y, Fortmann SP. Coronary heart disease mortality for six ethnic groups in California, 1990–2000. Ann Epidemiol. 2004;14(7):499–506.
4) Forouhi NG, Sattar N, Tillin T, McKeigue PM, Chaturvedi N. Do known risk factors explain the higher coronary heart disease mortality in South Asian compared with European men? Prospective follow-up of the Southall and Brent studies, UK. Diabetologia. 2006;49(11):2580-2588.
5) McCormick A, Fleming D, Charlton J. Morbidity Statistics from General Practice. Fourth National Study, 1991–1992. London: HMSO: Royal College of General Practitioners, Office of Population Censuses and Surveys, Department of Health; 1995.
6) Noor SK, Elmadhoun WM, Bushara SO, Ahmed MH. The Changing Pattern of Hospital Admission to Medical Wards: Burden of non-communicable diseases at a hospital in a developing country. SQUM J. 2015;15(4):e517.
7) Logue J, Murray HM, Welsh P, Shepherd J, Packard C, Macfarlane P, et al. Obesity is associated with fatal coronary heart disease independently of traditional risk factors and deprivation. Heart. 2011;97(7):564-568.
8) Li HX, Zhang F, Zhao D, Xin Z, Guo SQ, Wang SM, et al. Neck circumference as a measure of neck fat and abdominal visceral fat in Chinese adults. BMC Public Health. 2014;14(1):311.
9) Yang GR, Yuan SY, Fu HJ, Wan G, Zhu LX, Bu XL, et al. Neck circumference positively related with central obesity, overweight, and metabolic syndrome in Chinese subjects with type 2 diabetes: Beijing Community Diabetes Study 4. Diabetes Care. 2010;33(11):2465-2467.
10) Iacobellis G, Corradi D, Sharma AM. Epicardial adipose tissue: anatomic, biomolecular and clinical relationships with the heart. Nat Clin Pract Cardiovasc Med. 2005;2(10):536-543.
11) Cornier MA, Després JP, Davis N, Grossniklaus DA, Klein S, Lamarche B, Lopez-Jimenez F, Rao G, St-Onge MP, Towfighi A, Poirier P. Assessing adiposity: a scientific statement from the American Heart Association. Circulation. 2011;124(18):1996-2019.
12) Stabe C, Vasques AC, Lima MM, Tambascia MA, Pareja JC, Yamanaka A, Geloneze B. Neck circumference as a simple tool for identifying the metabolic syndrome and insulin resistance: results from the Brazilian Metabolic Syndrome Study. Clin Endocrinol. 2013;78(6):874-881.
13) Preis SR, Massaro JM, Robins SJ, Hoffmann U, Vasan RS, Irlbeck T, Meigs JB, Sutherland P, D'Agostino Sr RB, O'donnell CJ, Fox CS. Abdominal subcutaneous and visceral adipose tissue and insulin resistance in the Framingham heart study. Obesity. 2010;18(11):2191-2198.
14) Kaulgud RS, Pradeep N, Kumbhar DP, Vijayalaxmi PB, Kamath V, Swamy M. Coronary heart disease risk scores and their correlation with angiographic severity scores. Int J Biomed Res. 2013;4(6):257-263.
15) Kaulgud RS, Kaul A, Arun BS, Vijayalaxmi PB. Neck Circumference and Leg Length as Surrogate Markers of Coronary Artery Disease-Simplifying Cardiac Risk Stratification. JCDR. 2017;11(5):OC17.
16) Salvatici LQ, Stockins B, Lanas F, Potthow M, Neira V, Miranda R. P4407 Waist-hip ratio but not body-mass index correlates with the prevalence and severity of coronary disease determined by Gensini score. Eur Heart J. 2017;38(suppl_1).

17) Sianos G, Morel MA, Kappetein AP, Morice MC, Colombo A, Dawkins K, van den Brand M, Van Dyck N, Russell ME, Mohr FW, Serruys PW. The SYNTAX Score: an angiographic tool grading the complexity of coronary artery disease. EuroIntervention. 2005;1(2):219-227.
18) Capodanno D, Di Salvo ME, Cincotta G, Miano M, Tamburino C, Tamburino C. Usefulness of the SYNTAX Score for Predicting Clinical Outcome After Percutaneous Coronary Intervention of Unprotected Left Main Coronary Artery Disease. Circ Cardiovasc Interv. 2009;2(4):302-308.
19) Doğdu O, Akpek M, Yarlıoğlueş M, Kalay N, Ardıç İ, Elçik D, Senarslan O, Kaya MG. Relationship between hematologic parameters and left ventricular systolic dysfunction in stable patients with multi-vessel coronary artery disease. Turk Kardiyol Dern Ars. 2012;40(8):706-713.
20) Neeland IJ, Patel RS, Eshtehardi P, Dhawan S, McDaniel MC, Rab ST, Vaccarino V, Zafari AM, Samady H, Quyyumi AA. Coronary angiographic scoring systems: an evaluation of their equivalence and validity. Am heart j. 2012;164(4):547-552.
21) Gensini GG. A more meaningful scoring system for determining the severity of coronary heart disease. Am J Cardiol. 1983;51:606.
22) Hossain MA, Akanda AK, Ullah M, Barai LC, Nizam Uddin N. Association of Waist-Hip Ratio with Angiographic Severity of Coronary Artery Disease in Patients with Acute ST-Segment Elevation Myocardial Infarction. Bangladesh Heart J. 2017;32(2):71-76.
23) Parsa AFZ, Jahanshahi B. Is the relationship of body mass index to severity of coronary artery disease different from that of waist-to-hip ratio and severity of coronary artery disease? Paradoxical findings. Cardiovasc J Afr. 2015;26(1):13-16.
24) Bakhoum SW, Sorour SM, Elramly MZ, Raslan HZ, Salama II. Impact of waist circumference on hospital outcome and coronary angiographic findings of patients with acute ST-segment elevation myocardial infarction. Egyptian Heart J. 2015;67(2):159-165.