
RELATIONSHIP BETWEEN BMI AND SEVERITY OF CORONARY ARTERY DISEASE IN FEMALE POPULATION OF PAKISTANI ORIGIN

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ABSTRACT

Objective: To assess relationship between BMI and severity of coronary artery disease in female population of Pakistani origin.

Design: Cross sectional observational study.

Place and Duration of Study: Armed Forces Institute of Cardiology – National Institute of Heart Diseases (AFIC-NIHD), 1st February 2010 to 31st August 2010

Patients and Methods: The study population included 132 female patients undergoing coronary angiography. Obesity was classified according to the BMI using the National Institutes of Health (NIH) criteria as Normal (BMI 21–24 kg/m²), overweight (BMI 25–29 kg/m²), obesity class I (BMI 30–34 kg/m²), Obesity class II (BMI 35 to 39 kg/m² and obesity class III (BMI 40 or above kg/m²).

Coronary angiography data were obtained from the Siemens Queries software system, which maintains the database including detailed angiographic findings of all patients at this institution. Significant lesions were defined as those with >70% diameter narrowing of coronary arteries (>50% for the left main coronary artery). We attempted to quantify the “severity of CAD” by ascertaining the prevalence of high-risk coronary anatomy (HRCA, defined as >50% stenosis of the left main coronary artery and/or significant three-vessel coronary artery disease).

Results: Comparing overall obese (BMI \geq 30) vs. non obese groups, a statistically significant low prevalence of HRCA was encountered in the obese group (26 of 56, 46.4% vs. 54 of 76, 79.5% $p < 0.05$)

Conclusion: We concluded that obesity is associated with less severe coronary artery disease in women population of Pakistani origin.

Key Words: Obesity, severity of coronary artery disease, coronary angiogram.

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INTRODUCTION

Cardiovascular disease is the primary cause of death in women. Rates of coronary artery disease (CAD) increase with advancing age in both sexes, although rates in women lag behind those in men by about a

decade. Because of their greater age, women with CAD are more likely to have co-morbidities such as diabetes, obesity and hypertension. Obesity by itself is associated with conventional cardiovascular risk factors (eg, hypertension, dyslipidemia, and diabetes mellitus^{1,2} novel risk factors (eg, inflammatory markers such as high-sensitivity C-reactive protein [hs-CRP] and interleukin-6 [IL-6]),³ and coronary artery endothelial dysfunction⁴. These associations provide a plausible biological link to epidemiological observations that indicate that obesity is associated with increased risks of both nonfatal and fatal cardiovascular events in women⁵⁻⁶

Although obesity has been implicated as an independent risk factor for CAD events in the general population, recent evidence has alluded to the presence of an apparent paradoxical relationship between obesity and cardiovascular prognosis in certain subsets of patients. In particular, data indicate that short-term outcomes and survival in patients with heart failure⁵ and in patients following coronary revascularization⁶⁻⁸ appear to be paradoxically better in obese compared to lean patients (obesity paradox). Indeed, the “obesity paradox” theme has generated considerable debate in recent literature;⁹ a study from Israel examined the relation between body mass index (BMI) and extent of CAD and suggested that obesity be considered a ‘negative predictor’ of coronary artery disease severity in patients referred for coronary angiography¹⁰. We attempted to explore this hypothesis in the Pakistani women.

OBJECTIVE

The objective of our study is to assess the relationship between BMI and the severity of coronary artery disease in a cohort comprising Pakistani women.

METHODOLOGY

Study Design: A cross sectional observational study.

Study Population: The study population included 132 female patients undergoing coronary angiography at AFIC/NIHD Rawalpindi between February 2010 and August 2010. Patient demographics and medical history including cardiovascular risk factor profile (age in years, gender, diabetes mellitus as per WHO

criteria¹¹, hypertension per Joint National Committee 7 criteria¹², cigarette smoking and family history of coronary artery disease) were abstracted from patient charts.

Obesity was classified according to the BMI using the National Institutes of Health (NIH) criteria as Normal (BMI 21–24 kg/m²), overweight (BMI 25–29 kg/m²), obesity class I (BMI 30–34 kg/m²), Obesity class II (BMI 35 to 39 kg/m² and obesity class III (BMI 40 or above kg/m²).

Coronary angiography data were obtained from the Siemens Queries software system, which maintains the database including detailed angiographic findings of all patients at this institution. Significant lesions were defined as those with >70% diameter narrowing of coronary arteries (>50% for the left main coronary artery). We attempted to quantify the “severity of CAD” by ascertaining the prevalence of high-risk coronary anatomy (HRCA, defined as >50% stenosis of the left main coronary artery and/or significant three-vessel coronary artery disease).

Statistical Analysis: Statistical analyses were performed using the SPSS 13.0 software package (SPSS, Inc., Chicago, Illinois). Continuous (Scale) data are presented as Mean ± Standard Error (SE). Differences in group means were assessed using independent Student’s t test and likelihood ratio chi-square test, and Fisher exact test as appropriate.

RESULTS

Our study cohort comprised 132 female patients and with a mean age of 57.8 years and mean BMI of 29.4 kg/m².

Risk factors like diabetes and hypertension were more common in obese women than in normal and overweight women as shown in table I.

Table I

	Normal / over weight	Obesity I/II/III	P value
Hypertension	42	30	0.8615
Diabetes	32	20	0.4770
Smoking	0	4	0.0304

comparing overall obese (BMI ≥ 30) vs. non obese groups, a statistically significant low prevalence of High Risk Coronary Anatomy (HRCA) was encountered in the obese group (26 of 56, 46.4% vs. 54 of 76, 79.5% p < 0.05) table II

Table II

P – value 0.006

	Mild/Moderate CAD Normal Coronaries/Minor CAD/Subcritical CAD	Severe CAD SVCAD/DVCAD/ TVCAD
Normal/Over weight	22 (20.5%)	54(79.5%)
Obesity I/II/III	30.(53.7%)	26(46.4%)

DISCUSSION

The prevalence of obesity is increasing across the globe, Pakistan being no exception. According to the National Health Survey 2001 the prevalence of obesity in Pakistan for the age group 25 to 64 is 13% for males and 23% for females¹³.

Obesity has traditionally been considered a cardiovascular risk factor and has been associated with an increased risk of developing CAD and mortality in the general population including women. Thus, it may be speculated that obese female patients should have worse outcomes than their non-obese counterparts; however, recent publications have suggested that obesity may actually be associated with better outcomes in patients with CAD undergoing revascularization procedures¹⁴

Our findings suggest that obese female patients being referred for coronary angiography have a paradoxically lower CAD burden and prevalence of high-risk coronary anatomy (significant left main or triple vessel disease) compared to their non-obese comparators despite a higher prevalence of diabetes and hypertension implying the presence of an apparent “obesity paradox”. The landmark “Women’s Ischemia Syndrome Evaluation (WISE) Study” also indicated that normal-weight women with the metabolic syndrome have a significantly increased cardiovascular risk. Similarly, overweight and obese women with normal metabolism have a relatively low cardiovascular risk¹⁵.

We noted that although obese patients were found to have a lower CAD burden and lesion severity, these findings appear to be mitigated by the fact that obese patients were referred for coronary angiography at an earlier age. Our observations, although speculative, seem to also implicate the “tendency or bias of physicians” to refer obese patients (particularly those with additional cardiovascular risk factors) for angiography more liberally; the lower threshold for the decision to define coronary anatomy presumably driven by a higher prevalence of pronounced symptomatology, disability, and comorbidities frequent in overweight patients.

Another possible explanation for this finding is that measurement of BMI to define overweight and obesity does not quantify the magnitude or ratio of subcutaneous to visceral fat in a given individual. The visceral fat area, which is associated with an insulin-resistant state,¹⁶ appears to be an important link between many components of the metabolic syndrome, such as dyslipidemia and hypertension.¹⁷ Furthermore, classification of weight status by measurements of waist and hip circumference, the ratio of which may provide a clinically useful estimation of the proportion of abdominal or upper-body fat, also does not distinguish between accumulations of visceral and subcutaneous abdominal fat. Therefore, classification of weight status by routine measurements may underestimate the role of visceral fat distribution in the prediction of cardiovascular risk.

Although other potentially confounding variables like physical inactivity, socioeconomic factors, etc may have influenced our results, these were not studied, as this data was not readily available. The traditional risk factors viz. hypertension and diabetes were not analysed independently because of their increased prevalence in the obese group patients. So despite having increased prevalence of hypertension and diabetes, the obese females had less severe coronary artery disease further augmenting the theory of obesity paradox in the female population under study. The apparent negative association between obesity and CAD severity found in our study population appears to be mostly a reflection of physician practice patterns, in particular, the fact that obese patients were referred for coronary angiography at a younger age. Being a cohort study from a single institution, cohort selection bias cannot be excluded. Finally,

while our conclusions cannot be extrapolated to the general population, they appear to be hypothesis generating and deserve future exploration in a larger multi-center study.

CONCLUSION

We concluded that obesity is associated with less severe coronary artery disease in women population of Pakistani origin.

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