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ORIGINAL ARTICLE

Anthropometric Profile In Normolipidaemic Myocardial Infarction Patients In South Asia: A Case-Control Study

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ABSTRACT

The objective of the study was to evaluate the changes in anthropometric variables in normolipidaemic acute myocardial infarction (AMI) patients, and to determine the significance of waist-hip ratio and basal metabolic index in assessment of risk of myocardial infarction as compared to normal healthy controls.165 normolipidaemic AMI patients from India (87 males; 22 females) and Sri Lanka (36 males; 20 females) were recruited for the study.165 age and sex matched normal healthy controls were selected carefully. Anthropometric variables such as height (H), weight (W), waist circumference (WC), hip circumference(Hp), waist-hip ratio(W/H ratio), mid arm circumference (MAC), biceps skin fold thickness (BSFT), and triceps skin fold thickness (TSFT), was measured using standardized techniques. Anthropometric profiles varied markedly among cases and controls ($p<0.001$). The relative risk of MI was increased by 2.6 folds in subjects whose waist /hip ratio was ≥0.95 compared to those with normal waist/hip ratio. Waist-to-hip ratio is a useful phenotypic marker for determining the risk of myocardial infarction in patients in South Asia. Further research is needed from South Asia to assess the predictive ability of waist-hip ratio for cardiac disease in adults, after adjusting for potential confounders.

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Introduction

Coronary artery disease (CAD) is a major cause of mortality and morbidity in the industrialized world, which develops through a chain of events. The presence of certain risk factors elicits changes in the heart and vascular, some of which may initially be beneficial, but may be maladaptive or may become pathogenic when they progress. Cardiac biochemistry (hyperlipidaemia) is a subject of rapidly growing importance among Indian and Sri Lankan populations. Recently, there has been an attempt to evaluate simple phenotypic markers such as waist-to-hip ratio as risk factors for heart disease[2]. Waist –to-hip ratio has been suggested to be a better index than body mass index (BMI). A ratio of ≥ 0.85 for women and ≥ 0.9 for men is considered for the prediction of risk[2]. This is because fat stored around the waist is more likely to affect lipids in the blood and clog up arteries, than fat stored around the thighs and hips. Similarly a larger waist size has been found to be harmful, whereas larger hip size - possibly indicating lower-body muscle mass, has been shown to be protective[3]. The current study was undertaken to evaluate the anthropometric variables in normolipidaemic MI patients.

Setting Design and Patients

The study recruited 165 normolipidaemic acute myocardial infarction (AMI) patients from India (87 males; 22 females) and Sri Lanka (36 males; 20 females), and 165 age-sex matched normal healthy controls

admitted to the Intensive Cardiac Care Unit, Sharda Hospital, India, and Faculty of Medicine, University of Peradeniya, Sri Lanka. The diagnosis of AMI was established using a common diagnostic protocol: chest pain lasting for up to 3 hours, electrocardiographic (ECG) changes (ST elevation of 2 mm or more in at least two leads), and elevation in the enzymatic activities of serum creatine phosphokinase and aspartate aminotransferase. The design of this study was pre-approved by the institutional ethical committee board of Chaudhary Charan Singh University, Meerut (Uttar Pradesh), and informed consent was taken from the patients and controls.

An inclusion criterion was set for patients with the diagnosis of AMI, with a normal lipid profile. Patients with diabetes mellitus, renal insufficiency, current and past smokers, with hepatic disease, or taking lipid lowering drugs or antioxidant vitamin supplements, were excluded from the study. Normolipidaemic status was judged by the following criteria: LDL<130mg/dl; HDL, ≥ 35 mg/dl; total cholesterol (TC), <200 mg/dl and triglycerides (TG), <150 mg/dl [4]. Ten ml of blood was collected after overnight fasting for the lipid profile assay.

Lipid Profile

TC, TG and HDL-cholesterol were analyzed enzymatically using kits obtained from Randox Laboratories Limited, Crumlin, UK. Plasma LDL-cholesterol was determined from the values of total cholesterol and HDL-cholesterol using the following formulae:

$$\text{LDL-cholesterol} = TC - \frac{TG}{5} - \text{HDL-cholesterol (mg/dl)}$$

Anthropometric Examination

The anthropometric examination measurement of height (H), weight (W), waist circumference(WC), hip circumference (Hp), waist-hip ratio(W/H ratio), mid arm circumference (MAC), biceps skin fold thickness (BSFT) and triceps skin fold thickness (TSFT), was done using standardized procedures.

Height was measured in centimeters, and weight in kilograms, using a calibrated spring balance. Supine waist girth was measured at the level of umbilicus, with a person breathing silently, and standing hip girth was measured at the inter-trochanteric level.

Mid arm circumference was measured half way between the acromion process of the scapula and the tip of the elbow. Triceps skin fold thickness (TSFT) measurements were made at a point over the triceps muscle, mid way the acromion and olecranon process, on the posterior aspect of the arm.

Statistical Analysis

For statistical analysis, a two-sample t-test was performed, and the results were expressed as mean ± SD. P≤0.05 was considered significant.

Results

The findings of the present study are shown in[Table/Fig1]and[Table/Fig2].

[Table / Fig.1]. Lipid Profile in Control and AMI Patients

Variables	Control(n=165)	Patient (n=165)	P value (95%CI)
Age (Mean ± SD)	60.55 ± 3.98	61.84 ± 3.80	0.0037(61.26-62.42)
Total Cholesterol (mg/dl)	168.58 ± 12.16	186.44 ± 13.95	<0.001(184.31-188.56)
HDL-Cholesterol (mg/dl)	50.51 ± 6.78	41.27 ± 4.62	<0.001(40.56-41.97)
TC: HDL-C ratio	3.39 ± 0.36	4.57 ± 0.58	<0.001(4.48-4.65)
Triglycerides (mg/dl)	107.84 ± 11.51	128.96 ± 12.19	<0.001(127.10-130.82)
LDL-Cholesterol (mg/dl)	83.59 ± 11.95	119.37 ± 14.05	<0.001(17.22-21.51)
LDL:HDL-C ratio	1.90 ± 0.31	2.93 ± 0.51	<0.001(2.85-3.00)
TG: HDL-C ratio	2.17 ± 0.35	3.16 ± 0.49	0.3149(3.086-3.234)

[Table / Fig.2]. Anthropometric variables in Control and AMI patients

Variables	Control(n=165)	Patient (n=165)	P value (95%CI)
Height (cm)	1.63 ± 0.04	1.64 ± 0.05	>0.1 (1.63-1.64)
Weight (kg)	68.34 ± 3.97	72.01 ± 5.37	<0.001(71.19-72.82)
BMI (kg/m^2)	25.40 ± 1.20	26.16 ± 1.45	<0.01 (25.93-26.38)
Waist Circumference(cm)	93.70 ± 3.63	100.77 ± 6.06	<0.001(99.84-101.69)
Hip Circumference (cm)	100.01 ± 3.16	105.72 ± 5.23	<0.001(104.92-106.51)
Waist: Hip ratio	0.93 ± 0.01	0.95 ± 0.01	<0.02(0.94-0.95)
Mid Arm Circumference(cm)	29.70 ± 1.47	30.63 ± 1.87	<0.05(30.34-30.91)
Biceps skin fold thickness (mm)	6.95 ± 1.05	7.5 ± 1.38	<0.001(7.29-7.70)
Triceps skin fold thickness (mm)	11.97 ± 1.27	12.89 ± 1.69	<0.001(13.63-14.14)

The present study observed that anthropometric profile (W, WC, Hp, BSFT and TSFT) differed significantly between cases and controls. The relative risk of MI was increased by 2.6 folds in subjects whose waist /hip ratio was ≥0.95, compared to those with normal waist/hip ratio.

Discussions

We evaluated the utility of waist-height ratio for predicting myocardial infections in normolipidaemic subjects. The body weight (W), waist circumference (WC), mid arm circumference (MAC), hip circumference (Hp), and waist to hip ratio (W/H ratio) were significantly ($p<0.0001$) higher in MI patients, as compared to controls. A prior study has reported that waist to hip ratio is a dominant, independent, and predictive variable of CVD and CHD deaths in Australian men and women[2]. It has been argued that the assessment of obesity by waist-hip ratio would be a better predictor of CVD and CHD mortality than waist circumference, which in turn, is a better predictor than BMI. The recognition of central obesity is clinically important, as life style intervention is likely to provide significant health benefits. Another study reported that high hip circumference, relative to body size and waist circumference, predicts a low incidence of CVD and CHD, and total deaths in women and BMI and WC were the strongest independent predictors of CVD.[5] The present study further got support from South Asia, and argues for a need of further rigorous evaluation of this index.

The clinical usefulness of waist-to-hip ratio (W/H ratio) for predicting the risk of cardiovascular events was assessed with models based on the data from Framingham and Prospective Cardiovascular Munster (PROCAM) studies[6]. In these studies, abdominal fat was found to be the strongest predictor of cardiovascular complications in subjects whose W/H ratio was in the top quartile (>0.98 for men and >0.091 for women). The estimated percentage rate of coronary heart disease (CHD, $p<0.01$) and death ($p<0.01$), myocardial infarction ($p<0.01$), stroke ($p<0.01$), and total CVD ($p<0.01$), increased with the increasing quartile of W/H ratio in both men and women. In the highest W/H ratio, the number of subjects exceeding a 15% risk of developing a coronary event over the next 10 years was more than two-fold greater than in the lowest W/H ratio quartile. Their study concluded that abdominal deposition of fat assessed by the W/H ratio is a strong predictor of cardiovascular events.

Cardiovascular risk factors have been reported in Asian Indians, even though the prevalence of obesity is not high[7]. In a cross-sectional study that involved subjects from the low socioeconomical stratum, residing in the urban slums of New Delhi, approximately 68% of men and 88% of women had at least one risk factor for CVD. They concluded that Asian Indians have a higher cardiovascular risk, even when BMI and WC values are within normal range, and suggested that the definitions of "normal" ranges of BMI and WC need to be revised for Asian Indians.

Another study reported[8] the prevalence of overweight to be 13.6% and obesity to be 2.2% in myocardial infarct subjects; 45.5% of them had normal weight, and 38.4% were underweight. A higher W/H ratio (≥ 0.92) was observed in 11.4%. They found a positive correlation between the BMI and W/H ratio. In the present study, the mean BMI and W/H ratio of all the subjects was 26.56 and 0.96 respectively, tending towards overweight and higher W/H ratio, with a significantly higher BMI and W/H ratio in the study group, as compared to control subjects.

Based on the observations our study, we conclude that waist-hip ratio is a useful predictor of CVD than BMI.

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