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Original Research Article

To Determine the Association of Anthropometric Measurements and Lipid Profile with Sagittal Abdominal Diameter in Type 2 Diabetes Mellitus

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ABSTRACT

Objective: The aim of this study was to evaluate the correlation of anthropometric measurements and lipid profile with sagittal abdominal diameter (SAD) in type 2 diabetes patients.
Methods: This was a cross-sectional study. A total of 94 type 2 diabetic patients who have attended diabetic clinic were included in the study. All the type 2 diabetic patients of attending diabetic clinic OPD irrespective of age and sex were included in the study. The anthropometric parameters as well SAD were measures by standard method. Under aseptic precautions, 7ml of venous Blood sample in fasting state was drawn from clinically diagnosed cases of Diabetes Mellitus.
Results: More than one third of the patients were between 51-60 (42.6%) years. The mean age of the patients was 46.10 (±11.31) years. More than half (66%) of the patients were male. The increased level of TC, TG, LDL and VLDL was observed. However, decreased level of HDL was found. There was mild significant positive correlation between SAD and WC (r=0.43, p=0.001) & HC (r=0.42, p=0.001). However, the WC/HC ratio was negatively correlated with SAD (r=-0.56, p=0.001). There was poor positive correlation between BMI and SAD. None of the lipid levels were correlated with SAD. SAD was almost similar in different age groups as well as among male and female patients.
Conclusion: Anthropometric parameters above the threshold cut off values were found to be predictors of diabetes and other cardiovascular risk factors in various populations even though it is not clear which anthropometric parameter is ideal for a particular population.

Key words: Anthropometric, Diabetes mellitus, sagittal abdominal diameter.

INTRODUCTION

The world Health Organization (WHO) has predicted that the global prevalence of all diabetes increases from ~194 million in 2003 to~330 million in 2025 and that this increases will affect both industrialization and developing countries. [1-3] The impact on less developed countries is disproportionately high. Some of the countries expecting the greatest increase are India (38 million to 73 million), China (22 million to 46 million), Pakistan, Indonesia and Mexico and Their public health implications are formidable. [4]

Social and behavioral changes are regarded as key factors in the recent global explosion of type 2 diabetes, of these, the most important appear are: Decreased levels of physical activity and Over-consumption of energy-dense food. Ethnicity is an important determinant of susceptibility to insulin resistance, obesity, type 2 diabetes mellitus and other cardiovascular risk factors such as dyslipidemia (Ladeia et al, 2006; Shamir et al, 2008; Dahl-Jorgensen et al, 2005). [5-7] Different patterns of plasma lipid levels that exist independent of obesity and insulin resistance may be seen some of the ethnic groups. [8]

Abdominal height or sagittal abdominal diameter (SAD) has shown to be strongly associated with glucose intolerance cardiovascular risk [9-13] and mortality (Kahn et al, 1996; Seidell et al, 1994). [14,15] Despite compelling data, the role of SAD has been overlooked, whereas waist girth has received more attention. [16-17,9] Given that insulin resistance is a major health culprit, there are surprisingly little data comparing different anthropometric measures as correlates to insulin resistance determined by gold standard techniques.

Association between obesity and an increased risk of type 2 diabetes has been documented. The distribution of fat in body appears to be an important modulator of the clinical impact of obesity. Thus, type 2 diabetes and other cardio vascular risk factors are particularly closely associated with visceral obesity. [18-20]

The aim of this study was to evaluate the correlation of anthropometric measurements and lipid profile with sagittal abdominal diameter in type 2 diabetes patients.

MATERIALS AND METHODS

Study design: This was a cross-sectional study conducted in a tertiary care hospital in Uttar Pradesh over a period of one year. The study was approved by the Ethical Committee of the institute. The consent was taken from each patient before enrolling in the study.

Study subjects: A total of 94 type 2 diabetic patients were included in the study. All the type 2 diabetic patients of attending diabetic clinic/OPD irrespective of age and sex were included in the study. Any condition affecting haemoglobin levels, anemia, polycythemia, hemoglobinopathy, any condition affecting lipid profile and thyroid disease were excluded from the study.

Data collection: After taking a medical history, a detailed physical and systemic examination was conducted for all participants and the data was recorded in a predesigned questionnaire.

Measurements: Weight, height, waist circumference (WC), hip circumference (HC), sagittal abdominal diameter and BMI were measured. Weight was measured to the nearest 0.1 kg in light clothing and standing barefoot by using a weighing machine. Height was measured to the nearest 0.5 cm using a wooden meter fixed on the wall while the subject was standing relaxed, barefoot and heels together touching the wall. Waist and hip circumference (WC) were measured twice to the nearest 0.5 cm, with a flexible but non-elastic measuring tape. Waist circumference was measured at level of the natural waist (the narrowest part of the torso) or one finger width below the umbilicus. Hip circumference was measured at the maximum circumference of the buttocks posteriorly and the symphysis pubis anteriorly, in a horizontal plane with the subject in the standing position and breathing normally. The BMI was calculated by dividing the body weight (in kilograms) by the height (in meters squared). SAD (anteroposterior) or "abdominal height" was measured after a normal expiration to nearest 0.1 cm in supine position with straight legs on a firm examination table, without clothes in the measurement area. At the level of iliac crest SAD was measured using a ruler and water level. SAD was the distance between the examination table up to the horizontal level. Under aseptic precautions, 7ml of venous Blood sample in fasting state was drawn from clinically diagnosed cases of Diabetes Mellitus. Then the blood sample was divided into 3 test tubes, marked as 1, 2 and 3 and analyzed respectively for lipid parameters.

Statistical analysis: The data was analysed by using SPSS 16.0 version (Chicago, Inc., USA). The results are presented in mean±SD and percentages. The Pearson correlation coefficient was used to find the correlation among the study parameters. The Unpaired t-test was used to compare the SAD between male and female. The one way analysis of variance (ANOVA) was used to compare the SAD among different age groups. The linear regression analysis was carried out to find the percentage of variation in SAD explained by WC/HC ratio. The p-value<0.05 was considered significant.

RESULTS

More than one third of the patients were between 51-60 (42.6%) years followed by 41-50 (34%), 31-40 (20.2%) and <30 (3.2%) years. The mean age of the patients was 46.10 (±11.31) years. More than half (66%) of the patients were male (Table-1).

Table-2 presents the distribution of the subjects according to anthropometric parameters. The average height of the patients was 162.12 (±10.88) cms with weight 71.42 (±9.22) kg. The BMI was 23.71 (±7.14) kg/m^2. The WC, HC and WC/HC were 93.27 (±11.73), 94.72 (±12.84) and 1.92 (±10.72) respectively. The SAD was 21.64 (±3.66).

The increased level of TC, TG, LDL and VLDL was observed. However, decreased level of HDL was found (Table-3).

There was mild significant positive correlation between SAD and WC (r=0.43, p=0.001) & HC (r=0.42, p=0.001). However, the WC/HC ratio was negatively correlated with SAD (r=-0.56, p=0.001) (Fig.1). There was poor positive correlation between BMI and SAD. None of the lipid levels were correlated with SAD (Table-4).

There was no significant (p>0.05) difference in the SAD level among different age groups. However, SAD was higher in the patients of age<30 years than other age groups. The level of SAD was insignificantly (p>0.05) was higher among female patients males (Fig.2).

Table-1: Age distribution of the subjects

Age and gender	No.(n=94)	%
Age in years		
<30	3	3.2
31-40	19	20.2
41-50	32	34.0
51-60	40	42.6
Mean±SD	46.10±11.31	
Gender		
Male	62	66.0
Female	32	34.0

Table-2: Distribution of the subjects according to anthropometric parameters

Anthropometric parameters	No. (n=94) (Mean±SD)
Height in cms	162.12±10.88
Weight in kg	71.42±9.22
BMI in kg/m^2	23.71±7.14
WC in cm	93.27±11.73
HC in cm	94.72±12.84
WC/HC	1.92±10.72
SAD	21.64±3.66

Table-3: Distribution of the subjects according to Lipid profile

Lipid profile	Mean±SD
TC	237.85±58.88
TG	172.14±56.86
HDL	39.24±8.06
LDL	130.69±49.16
VLDL	67.92±47.52
LDL/HDL	3.53±1.65
TC/TG	1.45±0.35

Table-4: Correlation coefficient (r) between SAD & anthropometric parameters and lipid profile

Anthropometric parameters/Lipid profile	SAD	
	r	p-value
BMI	0.16	0.08
WC	0.43	0.001*
HC	0.42	0.001*
WC/HC	-0.56	0.001*
TC	0.07	0.43
TG	-0.04	0.97
HDL	-0.05	0.53
LDL	0.05	0.55
VLDL	0.04	0.63
LDL/HDL	0.11	0.22

*Significant

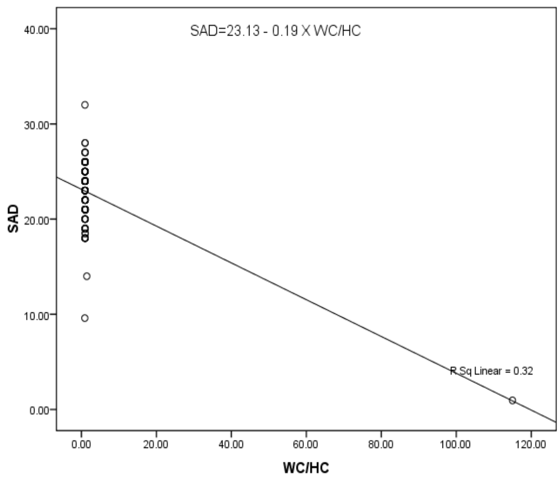

Fig.1: Scatter diagram showing correlation between WC/HC and SAD

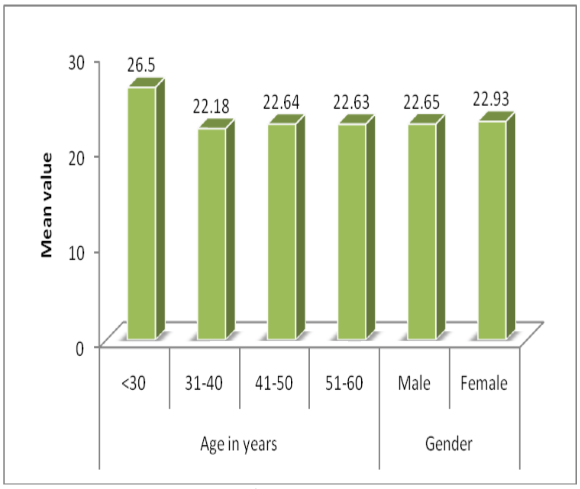

Fig.2: Comparison of SAD with age and gender

DISCUSSION

In the present study, we have evaluated the association of pattern of lipid profile and anthropometric parameters with SAD in type 2 diabetic patients. In the present study, the age of most of the diabetic patients was 51-60 years.

The increased level of TC, TG, LDL and VLDL was observed, however, decreased level of HDL was found in the present study.

This study reveals high prevalence of hypercholesterolemia, hypertriglyceridemia, high LDL-C and low HDL-C levels which are well known risk factors for cardiovascular diseases. Insulin affects the liver apolipoprotein production. It regulates the enzymatic activity of lipoprotein lipase (LpL) and Cholesterol ester transport protein (CET). All these factors are likely cause of dyslipidemia in diabetes mellitus. [21] Moreover, insulin deficiency reduces the activity of hepatic lipase and several steps in the production of biologically active LpL may be altered in DM. In our study, we have given preference to main disorder in lipid metabolism i.e. hypertriglyceridemia and hypercholesterolemia. This finding is in concord with a previous study. [22]

The above discussion clearly indicates the clinical significance of various lipid parameters including total cholesterol, TG, HDL and LDL in predisposing diabetic patients to cardiovascular complications. The significant correlation of HbA1c with all these lipid parameters points towards the usefulness of HbA1c for screening high-risk diabetic patients.

In this study, there was no significant (p>0.05) difference in the SAD level among different age groups. However, SAD was higher in the patients of age<30 years than other age groups. The level of SAD was insignificantly (p>0.05) higher among female patients than males. (Lílian R et al, 2010) had found positive and statistically significant correlations of age with SAD in both sex. SAD was correlated with the anthropometric variables, especially with waist circumference and BMI. [23] There was mild positive correlation between SAD and WC & HC. However, the WC/HC ratio was negatively correlated with SAD. There was poor positive correlation between BMI and SAD. In present study, lipid levels were not correlated with SAD.

One of the limitations of the present study is smaller sample size and not included healthy controls, the study having large sample size with control group is being recommended to have robust insight for cut off values for the prediction of diabetes.

CONCLUSION

Anthropometric parameters above the threshold cut off values were found to be predictors of diabetes and other cardiovascular risk factors in various populations even though it is not clear which anthropometric parameter is ideal for a particular population.

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