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Original Research Article

A Hospital-Based Assessment of Visceral Obesity using ABSI and BMI in Type 2 Diabetes: An Analytical Assessment

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Abstract

Aim: The aim of the present study was to examine the associations between two indicators and diabetes risk, and to investigate their performance in identifying diabetes compared with BMI and WC.

Methods: A cross sectional study conducted in Department of General medicine, Patna medical college and Hospital, Patna, Bihar, India for 1 year on 200 type 2 diabetes patients. Weight, height and BMI and blood investigations (CBC, LFT, KFTS. electrolytes, HbA1C, HDL, LDL, triglycerides, thyroid profile) and USG abdomen was done to assess fat thickness.

Results: The variable subcutaneous fat thickness (cm) was not normally distributed (Shapiro-Wilk test: $p \leq 0.001$). The variable visceral fat thickness (cm) was not normally distributed (Shapiro-Wilk Test: $p=0.006$). The 40% of the participants had V/S fat ratio: <2.5. 60% of the participants had V/S fat ratio: >2.5. There was a significant difference between the 2 groups in terms of ABSI Z-score ($W=702.000$, $p \leq 0.001$), with the median ABSI Z-Score being highest in the V/S fat ratio: >2.5 groups.

Conclusion: ABSI was better in assessing visceral obesity compared to BMI so can be used along with other markers in assessing cardiovascular risk.

Keywords: Type 2 Diabetes Mellitus, Obesity, ABSI, BMI, Waist Circumference, ABSI Z Score.

Introduction

Diabetes is a group of metabolic disease characterised by chronic hyper glycemia and the prevalence of diabetes mellitus is increasing considerably in India. Uncontrolled T2DM can lead to cardiovascular disease, diabetic retinopathy, diabetic neuropathy, and diabetic nephropathy (WHO). [1] Diabetes mellitus (DM) is the ninth leading cause of death worldwide. Globally, one in 11 adults is diagnosed with DM and approximately 90% of cases are type [2] diabetes mellitus (T2D). Overweight and obesity are the fifth leading cause of global

death and are the prevalence is increasing day by day in India because of sedentary life style. It contributes to premature death.1 Visceral obesity is associated with increased risk for several metabolic disorders such as cardio metabolic diseases, inflammatory diseases, and DM. [3-6] So, visceral obesity is the deciding factor in cardiovascular risk of obese and diabetes patients.

Body mass index (BMI), widely used since the early 1990s worldwide for classifying overweight

and obesity, as well as studying obesity associated risks, provides reliable information concerning body weight excess, but does not differentiate fat from lean mass. [7-9] Waist circumference (WC) is a simple anthropometric parameter for abdominal adiposity and it reflects visceral obesity better than BMI. [10] The VAI, which is comprised of anthropometric measures like BMI, WC and clinical measures of serum triglycerides (TG) and high-density lipoprotein-cholesterol (HDL-C) levels, was shown to be a better surrogate index than these single anthropometric indices in predicting insulin resistant-related metabolic disorders. [11] Therefore, we hypothesize that non-invasive, clinically measurable surrogates could be useful in

identifying body fat distribution and help predict diabetes risk. We aim to examine the associations between these two indicators and diabetes risk, and to investigate their performance in identifying diabetes compared with BMI and WC.

Material & Methods

A cross sectional study conducted in Department of General medicine, Patna medical college and Hospital, Patna, Bihar, India for the period of one year on 200 type 2 diabetes patients. The study was approved by ethical committee & informed consent was taken.

Inclusion criteria

Patients with age >40 years both male and female (post-menopausal age group) and T2DM were included in the study.

Exclusion criteria

Patients with the type 1 DM, pregnant female, history of smoking, alcohol and other drug abuse, patients taking steroids, immunosuppressive and anti-retroviral agents, familial dyslipidemia, diagnosed with intra-abdominal tumours, patients with chronic liver disease and kidney disease, hypothyroidism, Cushing syndrome, hypoproteinemia and congestive heart failure were excluded from the study.

Anthropometric and clinical assessment

After taking written and informed consent 150 type 2 diabetes patients, they are subjected to extensive history taking, anthropometric measurements (Weight, height and BMI), blood investigations (CBC, LFT, KFTS. electrolytes, HbA1C, HDL, LDL, triglycerides, thyroid profile) and USG abdomen to assess fat thickness

Table 1: BMI classification for Asian population.

Below 18.5	Underweight
18.5-22.9	Normal weight
23.0-24.9	Pre-obesity (overweight)
25.0-29.9	Obesity class I
>30.0	Obesity class II

The WC was measured at the midpoint between the last rib and the top of the iliac crest with stretch-resistant tape. The BMI status (normal, overweight, and obese) of the participants were assigned based on WHO BMI cut off points for Asian

population.

ABSI (m 11/6, kg 2/3) and its standard deviation score (SDS) were calculated using the following formula:

$WC/BMI^{2/3}$

$Height^{1/2}$

WC in meter, height in meters

The ABSI is classified into risk classes by means of the ABSI-z value (z value) derived from the ABSI. The calculation is made according to the following formula:

ABSI-Z=$SI-ABSI\ mean\ (sex, age)/ABSI\ std\ (age, sex)$

With the indices mean: average and std: standard deviation.

Table 2: ABSI-Z risk

Less than -0.868	Very low
Between -0.868 and -0.272	Low
Between -0.272 and +0.229	Average
Between +0.229 and +0.798	High
Greater than +0.798	Very High

Statistical analysis

Statistical analysis will be done using statistical package for social survey (SPSS). The data obtained would be analyzed using Student's t test, Fisher exact test, chi squared test, non-parametric test (Wilcoxon Mann Whitney U test) and level of significance will be set at $p<0.05$.

Results

Table 3: Distribution of the participants in terms of subcutaneous fat thickness and visceral fat thickness

Subcutaneous fat thickness (cm)	
Mean (SD)	1.77 (0.52)
Median (IQR)	1.75 (1.4-2)
Range	1-3.2
Visceral fat thickness (cm)	
Mean (SD)	5.36 (1.84)
Median (IQR)	5.25 (4-6.5)
Range	2.1-10

The variable subcutaneous fat thickness (cm) was not normally distributed (Shapiro-Wilk test: $p\leq0.001$). The variable visceral fat thickness (cm) was not normally distributed (Shapiro-Wilk Test: $p=0.006$).

Table 4: Distribution of the participants in terms of V/S fat ratio

V/S fat ratio	Frequency	Percent (%)	95% CI (%)
<2.5	80	40	26.6-42.2
>2.5	120	60	57.8-73.4

The 40% of the participants had V/S fat ratio: <2.5. 60% of the participants had V/S fat ratio: >2.5.

Table 5: Association between V/S fat ratio and parameters

Parameters	V/S fat ratio		P Value
	<2.5, (n=80)	>2.5, (n=120)	
Age (years)	54.69± 10.09	57.06± 10.17	0.200
Gender			
Male	44 (55)	72 (60)	0.850
Female	35 (45)	48 (40)	
Duration of diabetes (years)	7.06± 4.64	9.62± 5.10	0.001
BMI (kg/m²)	24.6±3.21	25.92±4.05	0.042
ABSI	0.08± 0.00	0.09± 0.00	<0.001
ABSI Z-score	0.16± 0.41	1.15± 1.02	<0.001
HbA1c (%)	7.83±1.61	9.63± 2.75	<0.001
ABSI Z risk group			
Very low	0	0	<0.001
Low	12 (15)	3 (2.5)	
Average	32 (40)	9 (7.5)	
High	28 (35)	48 (40)	
Very high	8 (10)	60 (50)	

The mean (SD) of ABSI in the V/S fat ratio: <2.5 group was 0.08 (0.00) and >2.5 group was 0.09 (0.00). There was a significant difference between the 2 groups in terms of ABSI (W=934.500, p≤0.001), with the median ABSI being highest in the V/S fat ratio: >2.5 group. There was a significant difference between the 2 groups in terms of ABSI Z-score (W=702.000, p≤0.001), with the median ABSI Z-Score being highest in the V/S fat ratio: >2.5 groups. The mean (SD) of ABSI Z-score in the V/S fat ratio: <2.5 group was 0.16 (0.41). The mean (SD) of ABSI Z-score in the V/S fat ratio: >2.5 group was 1.15 (1.02). There was a significant difference between the various groups in terms of distribution of ABSI Z risk group ($\chi 2$=52.241, p≤0.001).

The area under the ROC curve (AUROC) for BMI (kg/m²) predicting V/S fat ratio: >2.5 vs V/S fat ratio: <2.5 was 0.593 (95% CI: 0.5-0.685), thus demonstrating poor diagnostic performance. It was statistically significant (p=0.042). At a cut off of BMI (kg/m²) ≥27, it predicts V/S fat ratio: >2.5 with a sensitivity of 43%, and a specificity of 78%. The area under the ROC curve (AUROC) for ABSI predicting V/S fat ratio: >2.5 vs V/S fat ratio: <2.5 was 0.815 (95% CI: 0.748-0.882), thus demonstrating good diagnostic performance. It was statistically significant (p≤0.001). At a cut off of ABSI ≥0.085, it predicts V/S fat ratio: >2.5 with a sensitivity of 74%, and a specificity of 76%. The area under the ROC curve (AUROC) for ABSI Z score predicting V/S fat ratio: >2.5 vs V/S fat ratio: <2.5 was 0.861 (95% CI: 0.802-0.92), thus demonstrating good diagnostic performance. It was statistically significant (p≤0.001). At a cut off of ABSI Z-score ≥0.565, it predicts V/S fat ratio: >2.5 with a sensitivity of 78%, and a specificity of 82%.

Discussion

Diabetes mellitus (DM) is the ninth leading cause of death worldwide. Globally, one in 11 adults is diagnosed with DM and approximately 90% of cases are type 2 diabetes mellitus (T2D). [12] Excessive body fat disposed in the ectopic tissue, such as visceral adiposity tissue (VAT), may cause dysfunctional adiposity and it plays a vicious role in metabolic diseases. [13] In addition, body fat distribution is related to metabolic disturbances and metabolic disorders. [14] Thus, knowing the ability to predict the

visceral adiposity index for diabetes risk is greatly needed.

There was a significant difference between the 2 groups in terms of ABSI Z-score (W=702.000, p≤0.001), with the median ABSI Z-score being highest in the V/S fat ratio: >2.5 group. The mean (SD) of ABSI Z-score in the V/S fat ratio: <2.5 group was 0.16 (0.41) and >2.5 group was 1.15 (1.02). The 2.5%, 7.5%, 40% and 50% of V/S ratio group were belong to ABSI low risk, average risk, high risk and very high-risk class respectively. There was a significant difference between the various groups in terms of distribution of ABSI Z risk group ($\chi 2$=52.241, p≤0.001). Gažarová et al in his study found that visceral fat area 11.4% of participants were in the risk obese group and by ABSI mortality risk there were 22% of subjects with high risk (4.8% and 28.3% for men and women, respectively) and 19.1% with very high risk (11.1% and 22% for men and women, respectively). Our results were also similar to this. [15]

The area under the ROC curve (AUROC) for BMI (kg/m²) predicting V/S fat ratio: >2.5 vs V/S fat ratio: <2.5 was 0.593 (95% CI: 0.5-0.685), thus demonstrating poor diagnostic performance compared to ABSI which was 0.815 (95% CI: 0.748-0.882), thus demonstrating good diagnostic performance. Gomez-Peralta et al in his study the AUROC of ABSI was 63.1% (95% CI 54.6-71.6%; p=0.003) and an ABSI value of 0.083 m11/6 kg−2/3 was the optimal threshold in discriminating patients with sarcopenic obesity (sensitivity: 48%, specificity: 73%). [16] Compared to this study, in our study we found that sensitivity of ABSI is more (74%) in detecting visceral obesity.

Bertoli et al in his study found that the joint use of BMI and ABSI was also more strongly associated with VAT than BMI alone (BIC=22930 vs. 23479). We also found similar conclusion in our result. [17] The V/F ratio is also significantly associated with HbA1c, Medication Statins, T/HDL Ratio, ASCVD Risk And Complications Like CAD, CVA, PAD. [18]

Conclusion

Thus, demonstrating ABSI can predict visceral fat better than BMI. Visceral obesity (V/S ratio) was significantly associated with duration of diabetes, HbA1c, T/HDL ratio, CAD, CVA, PAD, ASCVD risk. In our study we found that ABSI was more sensitive and specific than BMI in assessing visceral obesity which was similar to previous studies. We also found that cardiovascular risk also associated more with ABSI than BMI. ABSI and BMI are simple method for assessing cardiovascular risk and ABSI can be used along with other obesity markers to assess cardiovascular risks.

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