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Sagittal abdominal diameter as an indicator of metabolic syndrome in elderly population

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Abstract

Introduction: Metabolic syndrome (MetS) is defined as a set of risk factors that includes resistance to insulin, dyslipidemia, abdominal obesity and high blood pressure, andincreases the risk of cardiovascular diseases and diabetes. Modern lifestyle changes have increased the risk of metabolic syndrome and cardiovascular diseases. An early screening and detection can help to check the development of metabolic syndrome and thus the cardiovascular mortality and morbidity.

Methods: this case control study was done at a tertiary centrein Ajmer.For this study two groups were formed. The case group (patients with metabolic syndrome) and the control group (without metabolic syndrome), each were consisted of 100 patients.

Results: the mean age in case and control group was found to be 71.24±8.64 and 72.78±8.63 years, respectively. Maximum participants were from 60-80 years age in both groups.The mean blood glucose, SBP and DBP were significantly higher in case group than control group.Mean values of HbA1c, TC, LDL and TG were very significantly higher in case group patients (6.89±1.67 %, 222.99±52.88 mg/dL, 127.37±39.47 mg/dL and 152.54±47.63 mg/dL, respectively).Mean value of HDL was significantly lower in case group (38.61±8.86 mg/dL).The mean values of Body mass index, Sagittal abdominal diameter and Lipid accumulation product were significantly higher in patients of case group (28.23±2.25, 22.660±2.409 and 259.34±119.89, respectively). In patients with Metabolic syndrome, SAD was found to be significantly positively correlated with WC and TG while it was significantly negatively correlated with HDL. In patients with Metabolic-syndrome, LAP was found to be significantly positively correlated with WC, TG and FBS while it was significantly negatively correlated with HDL.

Conclusion: This study concludes that Sagittal abdominal diameter (SAD) can be used as an indicator of metabolic syndrome as it was found to be increasing with the severity of MetS.

Keywords: Metabolic syndrome (MetS), waist circumference (WC), IDF (International Diabetes Federation)

Introduction

Metabolic syndrome (MetS) is defined as a set of risk factors that includes resistance to insulin, dyslipidemia, abdominal obesity and high blood pressure, and increases the risk of cardiovascular diseases and diabetes.[1] The most up-to-date criteria to define MetS were prepared by the International Diabetes Federation (IDF) task force. In their guidelines, it has been established that abdominal obesity is no longer a compulsory component, and specific cut-off points should be used to classify waist circumference (WC) by ethnic groups, in addition to criteria for changes in glucose and lipid metabolism and high blood pressure.[2]

The IDF (International Diabetes Federation) has set up criteria for diagnosis of metabolic syndrome which are as under-[3]

1. Central obesity (defined as waist circumference with ethnicity specific values*) and any two of the following:
2. Raised triglycerides: > 150 mg/dl, or specific treatment for this lipid abnormality.
3. Reduced HDL cholesterol: < 40 mg/dl in males, < 50 mg/dl in females, or specific treatment for this lipid abnormality.
4. Raised blood pressure: systolic BP > 130 or diastolic BP > 85 mm Hg, or treatment of previously diagnosed hypertension.
5. Raised fasting plasma glucose: (FPG) >100 mg/dl, or previously diagnosed type 2 diabetes.

***Ethnic specific values for waist circumference in Asian-Indian Population**

South Asians Based on a Chinese, Malay and Asian-Indian population	Male	≥ 90 cm
	Female	≥ 80 cm

While several reports have suggested that the anteroposterior diameter of the abdomen, the sagittal abdominal diameter (SAD), is a superior correlate of metabolic syndrome criteria and insulin resistance than waist circumference, there has been little incorporation of this measure into routine clinical practice.[4] SAD has recently been suggested to be a superior predictor of the metabolic syndrome than visceral fat area (VFA) in a single report. VFA, measured at the umbilicus, is the current gold standard for the determination of obesity-related cardiovascular risk and is a determinant of metabolic risk factors and the metabolic syndrome after correction for body mass index (BMI) and WC. Further, VFA has been independently linked to the development of coronary artery disease.[5] Hence, the finding that SAD is a superior predictor of the metabolic syndrome than VFA potentially carries important implications. Firstly, SAD may be measured with the handmade abdominal caliper without requiring any imaging, with its associated costs. Secondly, while commercial software is available to automate the process of quantifying fat areas from imaging, the process remains time-consuming and requires human input for analysis of appropriate images. [6]

Indicators of body fat distribution are associated with cardiovascular risk factors in the elderly independently of BMI. Aging is associated with a decrease in height, a more central fat distribution, and a loss of muscle mass (sarcopenia). Accumulating data suggest that sagittal abdominal diameter (SAD) or “abdominal height” may be a better marker of intra-abdominal adiposity and cardio metabolic risk.SAD

seems particularly good in capturing visceral fat which during the supine measurement does not "float out" sideways, as would more be the case for subcutaneous fat.[7,8]

Materials and methods

This case control study was done at a tertiary care centre in Ajmer.For this study two groups were formed. The case group (patients with metabolic syndrome) and the control group (without metabolic syndrome), each were consisted of 100 patients. All patients >60 years of age admitted in ward of Tertiary care Hospital in central rajasthan and approach in outdoor were included in this study. Subjects with spinal deformity, abdominal tumors, abdominal scar, lump, significant ascites, pathological disease (cancer, insufficient renal and hepatic performance, and chronic inflammatory pathology),Subjects in whom anthropometry measurements were not feasible and subjects having history of chronic smoking were excluded from the study.

Waist circumference is measured according to WHO in Standing Position after normal expiration midway between lower rib margin and iliac crust.

Lipid profile – TC, LDL, TG, HDL, VLDL. Patient is advised overnight fasting of at least 8 hours and a blood sample is withdrawn in the morning and sent for testing in laboratory.

SAD was measured with a portable sliding beam, abdominal caliper. This instrument was hand made under our supervision by an artisan.At least two measurements were taken on each subject and the average was used.

SAD cutoff for identifying subjects with an elevated cardio metabolic risk taken as 22cm in men & 20cm in women.[9]

Data analysis: All the data was collected and entered into ms excel sheet for computations. Data were arranged into tabulated and representative graphical forms to analyze further. Appropriate statistical tests of significance were applied using spss version 22.0 to analyze the data statistically.

Result

Table 1: Age and Gendering Case & Control Group

Age Group	Case			Control		
	Gender		Total	Gender		Total
	F	M		F	M	
60-70	31	31	62	15	30	45
70-80	11	9	20	15	20	35
80-90	5	9	14	7	12	19
>90	2	2	4	1	0	1
Total	49	51	100	38	62	100
mean±SD	70.02±8.29	72.41±8.89	71.24±8.64	72.68±8.78	72.83±8.61	72.78±8.63

The mean age in case group was found to be 71.24±8.64 years and maximum participants (82.00%) were from 60-80 years age group. In the case group, there were 49.00% female and 51.00% male. The mean

age was 70.02±8.29 years among female patients and 72.41±8.89 years among male patients of case group.

The mean age in control group was found to be 72.78±8.63 years and maximum participants (80.00%) were from 60-80 years age group. In the control group, there were 38.00% female and 62.00% male. The mean age was 72.68±8.78 years among female patients and 72.83±8.61 years among male patients of case group.

Table 2: Components of Metabolic Syndrome

	Case	Control	P value
WC	91.91 ±7.56	81.95±4.2	0.001 (S)
TG	152.54 ±47.63	123.14 ±17.06	
HDL	38.61 ±8.86	43.31 ±6.11	
SBP	138.38±18.86	87.46±9.32	
DBP	121.76±13.84	78.79±8.03	
FBS	126.93±43.73	94.6±20.53	

In our study it was found that mean values of WC, TG and HDL were very significantly different among case group 91.91±7.56cms, 152.54±47.63 mg/dl and 38.61±8.86 mg/dl, respectively) and control group (81.95±4.2cms, 123.14±17.06 mg/dl and 43.31±6.11 mg/dl, respectively).

The mean SBP and DBP were significantly higher in case group (138.38±18.86 and 121.76±13.84 mmHg, respectively) in comparison to control group (87.46±9.32 and 78.79±8.03 mmHg, respectively).

The mean value of fasting blood glucose was significantly higher in case group (126.93±43.73 mg/dl) in comparison to control group (94.60±20.53 mg/dl).

Table 3: Sagittal Abdominal Diameter In Case & Control Group

		Mean	S.D.	P value
Sagittal Abdominal Diameter	Case	22.660	2.409	0.001 (S)
	Control	19.98	1.37	

The mean values of Sagittal abdominal diameter was significantly higher in patients of case group (22.66 ± 2.40cms) in comparison to control group patients 19.98±1.37cms).

Table 4: Correlation of Sad With Criteria of Metabolic Syndrome In Cases

		SAD
WC	Pearson Correlation	.502**
	Sig. (2-tailed)	0
	N	100

TG	Pearson Correlation	.200*
	Sig. (2-tailed)	0.046
	N	100
HDL	Pearson Correlation	-.260**
	Sig. (2-tailed)	0.009
	N	100
FBS	Pearson Correlation	0.113
	Sig. (2-tailed)	0.265
	N	100
SBP	Pearson Correlation	0.077
	Sig. (2-tailed)	0.448
	N	100
DBP	Pearson Correlation	0.15
	Sig. (2-tailed)	0.136
	N	100

In the case group, SAD was found to be significantly positively correlated with WC and TG while it was significantly negatively correlated with HDL.

Table 5: Metabolic Syndrome Criteria and Sad In Cases Only

	Metabolic Syndrome Criteria			Total	P Value
	3 Criteria	4 Criteria	5 Criteria		
SAD	23.34±1.72	23.51±1.32	24.48±2.31	23.60±1.69	<0.05 (S)

Significant difference was found between mean values of SAD among different MetS criteria. The mean values of SAD in different criteria (criteria 3, 4 and 5) was 23.34±1.72cms, 23.51±1.32cms and 24.48±2.31cmsrespectively.

Discussion

Metabolic syndrome (MetS) is defined as a set of risk factors that includes resistance to insulin, dyslipidemia, abdominal obesity and high blood pressure, and increases the risk of cardiovascular diseases and diabetes.[10]The use of clinical and anthropometric indicators can help to identify the presence of MetS. The use of indicators to predict MetS may facilitate its identification in clinical practice, as they are simple, quick and functional. However, there is no consensus on the best indicator able to identify MetS in the elderly due to different functional characteristics and varied cut-off points, many of which are specific to young adults, and with different criteria for defining MetS.[10] Present study envisages the correlation of MetS with SAD

The mean values of Sagittal abdominal diameter and Lipid accumulation product were significantly higher in patients of case group, 22.660±2.409 cmand 259.34±119.89, respectively) in comparison to control group patients, 19.98±1.37 cm and 134.66±33.64, respectively). Thereby indicating a highervisceral adiposity in MetS compared to controls.

In patients with Metabolic syndrome, SAD was found to be significantly positively correlated with WC and TG while it was significantly negatively correlated with HDL

The mean values of SAD were found to be increasing with the MetS criteria. The mean values of SAD in different criteria (criteria 3, 4 and 5) were 23.34±1.72cms, 23.51±1.32cms and 24.48±2.31cms, respectively.

Conclusion

Sagittal abdominal diameter (SAD) with cutoff taken as 22 cm in men and 20 cm in women is easy, quick and reliable to measure with handmade abdominal caliper without requiring any imaging and it was found to be increasing with severity of metabolic syndrome in all cases. So it can be used as an indicator of metabolic syndrome.

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