Lipid accumulation products: A better marker for prediction of metabolic syndrome

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Abstract

Introduction: We can use lipid accumulation product as a clinical indicator for metabolic syndrome. However, there is few study regarding this, hence we aimed to use lipid accumulation product as clinical marker for predicting metabolic syndrome.

Materials and Methods: It is a hospital based study conducted over 640 subjects selected from metabolic syndrome OPD from Subharti Medical College, Meerut. Metabolic syndrome (MS) was defined according to the IDF criteria of MS. LAP can be calculated by using the formula, (waist circumference [cm] − 65) × (triglyceride [mM/L]) for men, and (waist circumference [cm] − 58) × (triglyceride [mM/L]) for women. The area under the receiver-operating characteristic curve was calculated for predicting LAP, a better marker.

Results: In our study, the prevalence of metabolic syndrome was 19.5%. The prevalence of metabolic syndrome was slightly higher in female (19.93%) as compared to male (19.09%). The area under the curve for LAP showed the highest prediction accuracy than waist to height ratio and BMI with an area under the ROC curve (AUC) of 0.905 and it was significantly higher than waist-to-height ratio (AUC = 0.829) and BMI (AUC = 0.702).

Conclusion: In conclusion, we can use LAP as a simple and precise marker for the risk of metabolic syndrome.

Keywords: Adiposity, Waist to height ratio, BMI, Lipid accumulation product, Metabolic syndrome.

Introduction

The metabolic syndrome reflects metabolic and cardiovascular risk factors viz. insulin resistance, hypertension, central obesity, prediabetes or diabetes, hyperinsulinaemia, and dyslipidemia.[1] There are various definitions of metabolic syndrome, but the most commonly used are, World Health Organization,[2] American Association of Clinical Endocrinologists (AACE),[3] the European Group for the study of Insulin Resistance,[4] the National Cholesterol Education Programme Adult Treatment Panel III.[5] International Diabetes Federation (IDF) proposed a new definition of metabolic syndrome in April 2006.[6]

The reason for the occurrence of metabolic syndrome is not well understood, but predisposing factors include aging, inflammation, obesity, sedentary lifestyle, and genetic predisposition. Epidemiological and experimental and studies have suggested that insulin resistance and visceral adiposity are the basis of this syndrome,[1] which results in alteration of lipid parameters, hypertension, glucose intolerance, proinflammatory state and prothrombotic state.

Since the original definition by the World Health Orgnization in 1998, the guideline for the metabolic syndrome has evolved, indicating growing clinical evidence and analysis by a variety of consensus conferences and professional organizations.[2] In general, as the age of an individual increases, also the chance to develop metabolic syndrome increases.[7] Lipid accumulation product has also been associated with cardiovascular disease[8] Diabetes.[9] Lipid accumulation product was generated to give a detailed account to which a subject had both increased waist circumference and triglyceride levels. Recently, a strong association between lipid accumulation product and metabolic syndrome was reported. Hence, we can use LAP as a strong indicator for the prognosis of metabolic syndrome.[10]

Materials and Methods

This cross sectional study was conducted in the Department of Biochemistry, Subharti Medical College and Chhatrapati Shivaji Hospital, Meerut. Informed consent were taken from every subjects prior to the study. The study was carried out on patients attending the specialty OPD for metabolic syndrome who fulfill the criteria of metabolic syndrome proposed by IDF 2005 within the age group of 16 to 65 years. Subjects who reported taking antihypertensive agents or hypoglycemic agents were considered to have high BP or a high fasting glucose level, respectively.

Weight: Weight was recorded in Kilogram by an electronic weighing machine (Commercial scale).

Height was recorded in centimeter using a height scale.

Abdominal girth was measured using a measuring tape and was recorded in centimeter. The level of measurement was midway between lower costal margin and iliac crest which approximately correspond to mid umbilicus level. The tape will be held in parallel to the floor and without compression of the skin at normal expiration.

Blood Pressure: The measurement of blood pressure is taken in sitting posture after resting for minimum of 10-15 minutes. Three consecutive reading is recorded at an interval 2-5 minutes on the same day or in subsequent OPDs

before final conclusion of high blood pressure.

Blood and Urine sample collection

The individual was requested for overnight fast. Blood was taken from anticubital vein in an autoclaved syringe. Sample was centrifuged and serum was separated. Fasting plasma glucose level and lipid parameters were done by enzymatic method by using automated analyzer**.** LAP is a multiplication product of triglyceride (mM/L) and subtraction products of waist circumference and 65 for men and for women 58 instead of 65.[9]

Statistical Analyses

We use SPSS version-16 for Statistical analysis and we considered a $p<0.05$ statistically significant. In order to find out the sensitivity and specificity, we had done ROC analysis for each adiposity measures and graphs were plotted between sensitivity and specificity and the overall diagnostic accuracy was quantified by using the value of AUCs.

Results

640 (331 were male and 309 were female) eligible subjects were enrolled for this study. In the present study, the prevalence rate of metabolic syndrome was around 19.5% (125 subjects, 66 were female and 59 were male). Out of the 640 subjects 121 (18.9%) subjects were hypertensive and 76 (11.87%) were Diabetic (graph -1). The mean anthropometric and other biochemical parameters are depicted in Table 1.

The mean levels of fasting blood glucose, waist circumference BMI, waist-to-height ratio and triglyceride were found to be increased significantly in male subjects as compared to female subjects while the mean levels of diastolic and systolic blood pressure were found to be increased insignificantly in male as compared to female subjects. In the present study, significantly decreased level of HDL-c was found in female subjects as compared to males whereas LAP was found to be significantly increased in female subjects as compared to male subjects. The AUC value for LAP, waist-to-height ratio and BMI were 0.905, 0.829 and 0.702 respectively, indicating AUC level for LAP was significantly higher as compared to waist-to-height ratio and BMI ($P < 0.001$). (Table 1)

Discussion

Visceral and subcutaneous adipose tissue can not be differentiated by measuring waist circumference. The visceral adiposity is more strongly associated as compared with subcutaneous adipose tissue for cardio-metabolic risks.[11] LAP is a simple indicator for metabolic syndrome and can be calculated with the help of triglycerides and waist circumference measurement. Weight and height is required for the measurement of BMI whereas waist and height is required for the measurement of waist to height ratio. So we can use LAP as the prognostic marker for metabolic syndrome. Lipolysis rate for visceral adipose tissue is higher which produces more adipocytokines and plasminogen activator inhibitor-1.[12]

In our study, we have found a higher level of AUC for LAP as compared to waist to height ratio and BMI. The AUC results for our study are in agreement with previous study which indicates the effectiveness of LAP.[13,14] It has been shown by previous study **t**hat LAP has the highest diagnostic accuracy for metabolic syndrome.[15] A study performed by

Table 1: Clinical characteristics of studied subjects (n = 640)

S. No.	Variables	Mean	Male (331)	Female (309)	p-Value
1	Hypertension, n (%)	121	70	51	
2	Diabetes Mellitus, n (%)	76	43	30	
3	WC (CM)	90.18 ± 8.50	93.72 ± 8.68	86.35 ± 6.37	<.001S
4	Waist to height (WHt) Ratio (%)	0.56 ± .042	0.56 ± .046	0.55 ± .036	<.001S
5	BMI (Kg/M2)	25.66 ± 3.55	25.95 ± 2.91	23.6 ± 4.66	<.01S
6	SBP (MM of Hg)	121.75 ± 8.44	121.90 ± 8.51	121.59 ± 8.38	=0.15NS
7	DBP (MM of Hg)	80.01 ± 3.88	80.37 ± 3.65	79.63 ± 4.08	=.015S
8	HDL-c (mg/dl)	47.28 ± 9.10	46.06 ± 8.43	48.58 ± 9.62	<.001S
9	TG (mM/L)	1.58 ± 3.70	1.66 ± 0.31	1.50 ± 0.40	< .001S
10	FBS (mg/dl)	88.06 ± 26.97	90.98 ± 33.68	84.94 ± 16.59	=.005S
11	Lipid Accumulation Product (LAP)	47.41 ± 19.50	44.74 ± 21.26	48.13 ± 17.42	=.03S

S- Stands for statistically significant, NS- Stands for statistically non-significant

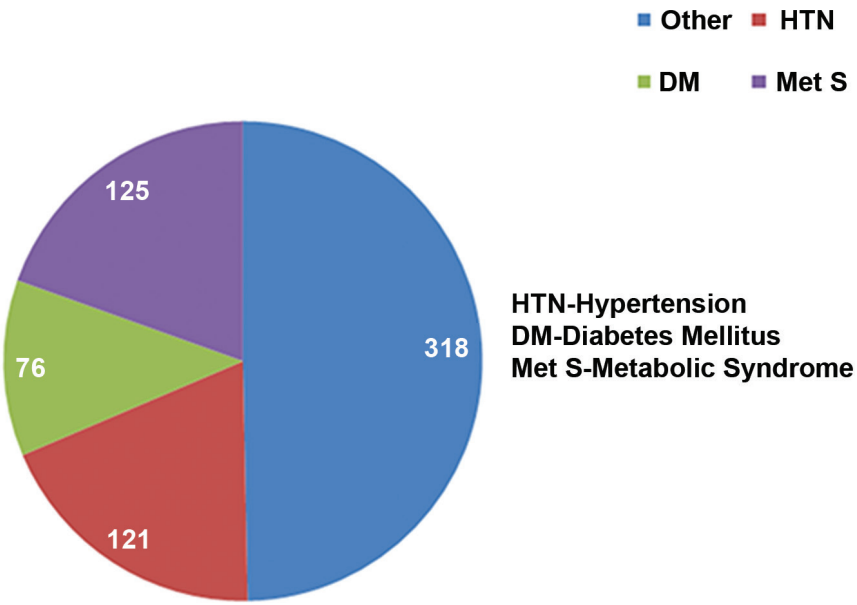

Fig. 1: Showing demographical representation of total study subjects

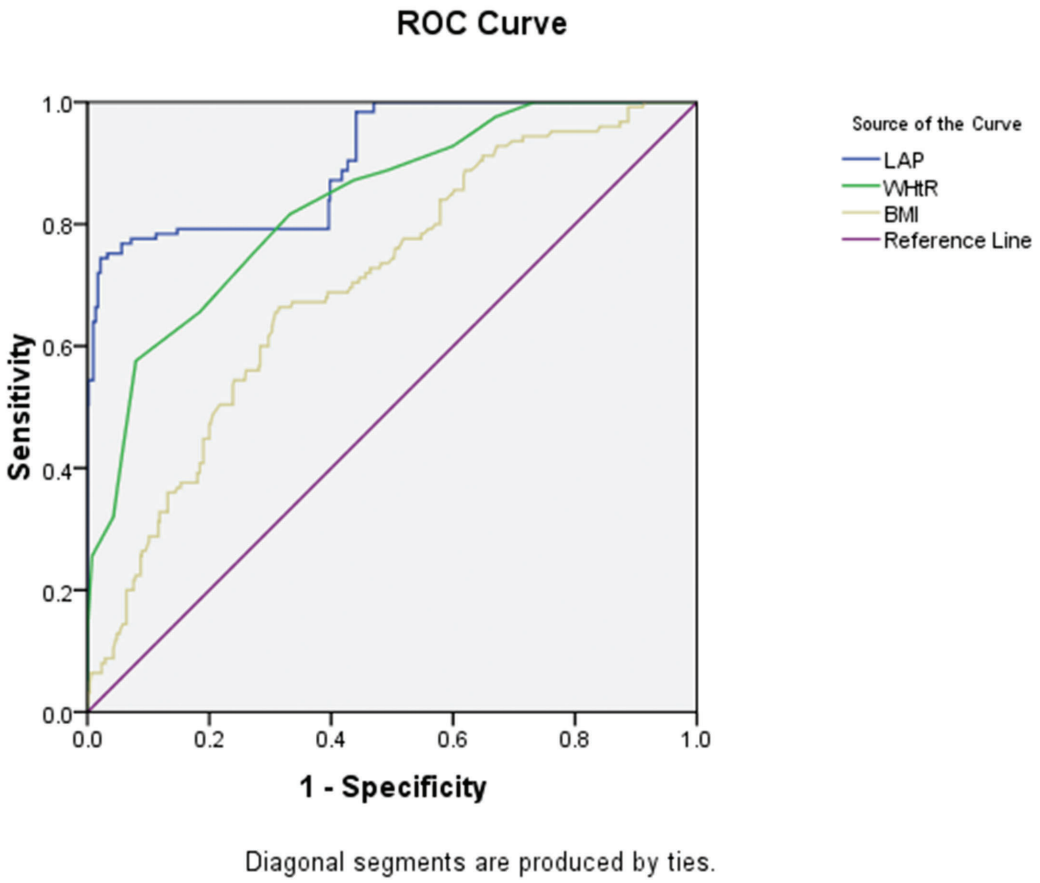

Fig. 2: ROC curves for adiposity index for measuring metabolic syndrome

Ejike et al reported an AUC of 0.937 for LAP in predicting metabolic syndrome.[16]

Pineda et al[17] in their study showed that the LAP and VAI (visceral adiposity index) is a prognostic marker for metabolic syndrome and CVD in Non-diabetic Venezuelan Adults. Wiltgen et al[18] studied on female subjects with PCOD and concluded that LAP is a additional risk factor for CVD in PCOS.

For obesity, the most commonly used parameter is BMI while it cannot measure central obesity. BMI can be altered due to fluid retention, lean and protective subcutaneous tissue, hence it may not be consider as a good prognostic marker. We use LAP as a good prognostic marker for visceral adiposity which indicates that the increase in the adipose tissue beyond the maximum extent to buffer and store safely.[19]

Future prospective study should consider individual lifestyle information, such as smoking and alcohol abuse, was not ascertained. These factors may have a great impact between the metabolic syndrome and obesity**.**

Conclusion

In the present study, the AUC value for LAP was higher as compared to waist to height ratio and BMI, hence we can use LAP as a simple and precise marker for the risk of metabolic syndrome.

Conflict of Interest: None

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