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ORIGINAL ARTICLE

Usefulness of Anthropometric Parameters and Non-HDL-C in the Early Screening of PCOS

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Abstract

Background: PCOS has been known to predispose to morbidity by its relationship with the metabolic syndrome and CVD. Dyslipidemia and alterations in anthropometric parameters are suggestive of the underlying metabolic risk in PCOS. **Methods:** Fifty patients of PCOS (aged 18-50 years) and equal number of healthy females of same age group were selected. Anthropometric measurements and lipid profile were estimated while non-HDL-C was calculated. The comparison amongst the groups was made on the basis of independent 't' test, Pearson's correlation and AUROC analysis.**Results:** Statistical analysis revealed that anthropometric measurements of the cases were significantly higher. Serum triglyceride and non-HDL-C levels were found to be significantly high whereas other lipid parameters could not correlate well. AUROC analysis revealed that the area under the curve for TG and non-HDL-C was found to be 0.653 (95% Confidence interval: 0.542, 0.763) and 0.627 (95% Confidence interval: 0.516, 0.739) respectively. **Conclusion:**The anthropometric parameters should be an integral part in the routine assessmentof PCOS. Also, the weight management, lifestyle counselling and early screening should start from adolescence to attenuate the severity of PCOS.

Keywords

PCOS, anthropometric parameters, non-HDL-C, triglycerides, CVD

Introduction

Polycystic ovary syndrome (PCOS) is a reproductive and metabolic endocrine disorder that causes anovulation and hyperandrogenism in women. It is the most common cause of infertility in women[1]. PCOS is associated with lifelong morbidities especially predisposing to metabolic syndrome and cardiovascular disease[2]. Dyslipidemia, a well-established risk factor for the progression of cardiovascular disease, is also seen in PCOS[3]. In fact, dyslipidemia is common in young adult women with PCOS. Distinct lipid patterns have been reported in PCOS; including low levels of high-density lipoprotein cholesterol (HDL-C), high levels of triglyceride (TG), TC and LDL-C[4]. LDL-C was considered to be the primary target to reduce CVD earlier but now owing to

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its several limitations [5] and prevalent metabolic syndrome in women with PCOS; researchers are now focusing their attention on non-HDL-C[6].The American and European Cardiological Societies, International Atherosclerosis Society, Expert Dyslipidemia Panel and the National Lipid Association have also strongly recommended the incorporation of non-HDL-C in routine lipid profile. Moreover, both the American College of Obstetricians and Gynaecologists (ACOG) as well as Androgen Excess and PCOS Society guidelines have recommended that women with PCOS should have a complete fasting lipid and lipoprotein evaluation as a part of their cardiovascular risk assessment[7].

Studies have found that atherogenic lipoprotein pattern in PCOS has been related to obesity Therefore, it is necessary to detect, prevent, and appropriately treat obesity. So, anthropometric measurements are used as a research tool for examining metabolic risk in women with PCOS because of their feasibility and utility[8]. There are not many studies in regards to the association of lipid profile especially non-HDL-C with anthropometric parameters in PCOS. In view of this, the present study was aimed to study the usefulness of anthropometric parameters and lipid profile in PCOS as well as to see whether there exist any correlation between the anthropometric parameters and lipid profile.

Methods

This is a case-control study conducted in the Department of Biochemistry in collaboration with Department of Obstetrics and Gynaecology in Maharishi Markandeshwar Super-speciality Hospital, Mullana, Ambala. Fifty patients of PCOS (aged 18-50 years) who presented for the first time in OPD were included in the study while patients of Diabetes mellitus, Hypothyroidism, Congenital adrenal hyperplasia, Hyperprolactinemia, Cushing's syndrome were excluded. Fifty aged matched healthy females were selected as controls. The study was duly approved by Institutional Ethical Committee for human research.

Detailed history of the patients was recorded. 3 ml blood was collected in a plain red-top vial and serum was separated using standard protocol. After the collection of blood sample, serum total cholesterol (TC), triglycerides (TG), High density Lipoprotein-Cholesterol (HDL-C) were estimated on the Simens Dimensions RxL in the Clinical biochemistry laboratory, MMIMSR. LDL-C and VLDL-C were calculated by friedwald formula and non-HDL-C was calculated by subtracting the HDL levels from total cholesterol levels i.e. TC – HDL-C. Two levels of internal quality control were run with every batch of patients' sample. The lab regularly participates in external quality control program of Christian Medical College (CMC), Vellore.

Statistical Analysis

The significance between the groups was determined using the independent-t test. Significance is considered only at $p < 0.05$. To compare the predictive values of TG and non-HDL-C, Receiver operating characteristic (ROC) curve analysis was done. The area under ROC (AUROC) is considered a global performance indicator for a prognostic factor. Greater area under curve of the ROC curve indicates better marker of the study[9]. Further, Pearson's correlation was also done to see the correlation of TG and non-HDL-C with anthropometric measurements. All the statistical analysis was done using SPSS 20 version.

Results

Out of the 100 individuals who had participated in the study maximum numbers of the patients (58%) were of age group 21-30 i.e. reproductive age. Among the lipid parameters estimated; only TG and non-HDL-C were found to be significantly elevated in cases as compared to controls (***Table 1)***.

The anthropometric measurements i.e., waist circumference (WC), hip circumference (HC), waist-height ratio (WHTR), waist to hip ratio (WHIPR) and body mass index (BMI) were measured on all the subjects

Table 1: Comparison of Lipid Parameters Between Test and Control Group

Parameters	Group	N	Mean ± S.D	p-value
LDL-C	Cases	50	102.33 ± 26.93	NS
	Control	50	97.00 ± 23.08	
TG	Cases	50	117.09 ± 54.50	.016*
	Control	50	94.40 ± 36.33	
TC	Cases	50	173.89 ± 31.45	NS
	Control	50	164.38 ± 26.36	
HDL-C	Cases	50	45.56 ± 11.69	NS
	Control	50	49.01 ± 13.01	
non-HDL-C	Cases	50	128.52 ± 30.13	.017*
	Control	50	115.35 ± 23.66	

N denotes the numbers of the subjects. p-value <0.05 is considered as significant.*

and were found to be significantly higher in cases as compared to controls (***Table 2).***

Further, to compare the predictive value of triglycerides and non-HDL-C levels AUROC analysis was done ***(Fig 1)***.

Table 2: Comparison of Anthropometric Parameters Between Test and Control group

Parameters	Group	N	Mean ±S.D	p-value
Weight (Kg)	Cases	50	63.44 ± 11.64	<0.001**
	Controls	50	53.81± 8.16	
Height (cm)	Cases	50	153.61 ± 8.05	.020*
	Controls	50	156.99 ± 6.06	
WC (cm)	Cases	50	90.94 ± 14.01	<0.001**
	Controls	50	74.25 ± 12.30	
HC (cm)	Cases	50	101.94 ± 12.05	<0.001**
	Controls	50	90.06 ± 10.32	
WHIPR	Cases	50	0.89 ± 0.06	<0.001**
	Controls	50	0.82 ± 0.06	
WHTR	Cases	50	0.60 ± 0.11	<0.001**
	Controls	50	0.47 ± 0.07	
BMI	Cases	50	27.42 ± 5.90	<0.001**
	Controls	50	21.42 ± 2.99	

N denotes the numbers of the subjects. p-value<0.05 is considered as significant,p <0.001is considered as highly significant**.*

The area under the curve for the triglycerides and non-HDL-C were found to be 0.653 (95% Confidence interval: 0.542, 0.763) and 0.627 (95% Confidence interval: 0.516, 0.739) respectively. The AUROC for TG was found to be marginally higher than non-HDL-C i.e. 0.653 at 0.640 sensitivity and specificity ***(Table 3).***

The Pearson's correlation coefficient was calculated to see the correlation between anthropometric parameters with TG, LDL-C and non-HDL-C. It was found that TG has significant positive correlation with age (0.304), weight (0.387), waist circumference (0.386), hip circumference (0.398), WHIPR (0.244), WHTR (0.407) and body mass index (0.420) while it was found to have significant negative correlation with height (-0.214). Similarly, non-HDL-C was found to have a significant positive relation with age (0.283), weight (0.262), waist circumference (0.309), hip circumference (0.364), WHTR (0.298) and body mass index (0.221), but no significant relation with height and WHIPR was observed ***(Table 4)***.

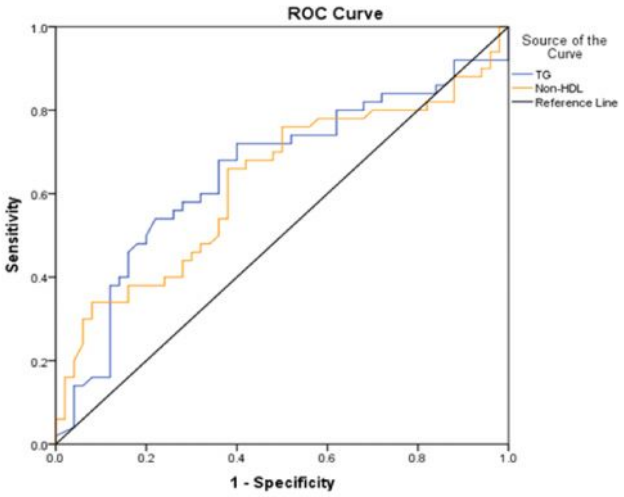

Fig 1: ROC Curve for TG and non-HDL-C

Discussion

The present study examined the anthropometric parameters and lipid patterns in fifty women with PCOS. Among all the anthropometric measurements; WC, HC, WHTR, WHIPR and BMI were found to be significantly higher in cases as compared to the controls. These findings are in accordance with the results of the studies conducted by Kar *et al.*[10], Crosignani PG *et al.*[11], Boyle *et al.*[12], Clark *et al.*[13] and Kiranmayee *et al* [14] who also found

Table 3: ROC Analysis for TG and non-HDL-C

Area Under the Curve								
	Area	Std. Error	p-value	95% Confidence Interval		Cut-off value	Sensitivity	Specificity
				Lower Bound	Upper Bound			
TG	0.653	.056	.009	.542	.763	96.450	.640	0.640
non-HDL-C	0.627	.057	.028	.516	.739	119.100	.620	0.620

Table 4: Correlation Between Anthropometric Measurements and Lipid Profile in Total Study Participants

Correlations			
		TG	**non-HDL-C**
Age	Pearson Correlation	.304**	.283**
	p-value	.002	.004
Weight (Kg)	Pearson Correlation	.387**	.262**
	p-value	.000	.008
Height (cm)	Pearson Correlation	-.214*	-.025
	p-value	.033	.808
WC (cm)	Pearson Correlation	.386**	.309**
	p-value	.000	.002
HC (cm)	Pearson Correlation	.398**	.364**
	p-value	.000	.000
WHIPR	Pearson Correlation	.244*	.140
	p-value	.014	.164
WHTR	Pearson Correlation	.407**	.298**
	p-value	.000	.003
BMI	Pearson Correlation	.420**	.221*
	p-value	.000	.027
**.Correlation is significant at the 0.01 level (2-tailed).			
*. Correlation is significant at the 0.05 level (2-tailed).			

higher WC, HC, WHTR, WHIPR and BMI in PCOS. Regarding the lipid parameters estimated only the triglycerides and non-HDL-C were found to be significantly elevated in cases as compared to controls whereas the non-significant difference was observed for rest of the parameters. A meta-analysis [15] comprising 30 studies on women in the reproductive age group found higher mean levels of LDL-C, non-HDL-C, and TG and lower HDL-C in women with PCOS as compared with healthy women and the results of our study are partly in accordance with this meta-analysis as we found high levels of non-HDL-C and TG whereas other lipid parameters were non-significant. This difference could be attributed to the small sample size of our study as well as the ethnic variation in the study group; most of the studies of the meta-analysis were from European and American populations.

Our study also explored the relationship between anthropometric measurements, TG and non-HDL-C. Triglycerides (TG) was found to have a significant positive correlation with age, weight, WC, HC, WHIPR, WHTR and BMI at 1% level of significance while significant negative correlation was found with height. Regarding non-HDL-C, it was also found to have a significant positive correlation with age, weight, waist circumference, hip circumference, WHTR and body mass index at 5% level of significance but non-significant correlation with height and WHIPR was observed.Apart from the t-test and Pearson's correlation, AUROC analysis was also done, which revealed that AUROC was marginally higher for TG than non-HDL-C.

Another important finding in the present study is that the LDL-C could not correlate significantly with PCOS associated dyslipidemia. Recent studies[16,17,18] have also inferred that LDL-C has now become a questionable stand-alone marker for the cardiovascular risk assessment owing to its several limitations [19]. It has also been depicted that the coronary events continue to occur in the population despite the use of LDL-C targeted therapy which suggests that LDL-C might not be the best predictor of CVD risk and thus, highlighting the need to reconstitute cardiovascular risk reduction algorithms beyond the focus on LDL-C levels alone[20]. Several researchers including, Ramjee *et al.* [21] and Kathariya *et al*. [22] found non-HDL-C to be more specific and sensitive indicator than friedewald calculated LDL-C for CVD risk assessment. Even the Rotterdam guidelines have suggested evaluation for the metabolic syndrome and indirectly indicated the need to measure only HDL-C and TG with relatively little attention to other lipid parameters in PCOS [23].

Another important finding of this study is that most of the cases were of reproductive age i.e. 21-30 years. Thus, the management of PCOS in young girls is of utmost priority as, PCOS is associated with menstrual dysfunction, infertility, pregnancy complications. Therefore, the focus should be on lifestyle modification since, it has been found to improve some clinical, metabolic and hormonal parameters in young girls with PCOS[24, 25] and also, in improving the fertility outcomes in PCOS.

PCOS can be considered as a real cardiovascular risk factor which affects the quality of life[26]. Therefore, screening for dyslipidemia is must as it helps to evaluate

cardiometabolic health for women with PCOS. Thus, an early preventive intervention with timely assessment of anthropometric parameters is required to halt the progress of atherosclerosis in these women.

Also, the weight gain prevention should start from adolescence to attenuate the severity of PCOS and anthropometric measurements should be an integral part of the routine examination in the assessment of PCOS.

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Conflict of Interest : None

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