Original Research Article

Study of metabolic syndrome in south Indian PCOS women

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ABSTRACT

Introduction: PCOS is one of the common endocrine disorders in women leading to various complications like infertility, menstrual, psychological disturbances and metabolic syndrome. The objectives of this study were to study the clinical and biochemical parameters of metabolic syndrome in women of reproductive age group with PCOS.

Materials and Methods: This cross-sectional study was conducted in a tertiary care centre from September 2018 to June 2020. Fifty six women diagnosed with PCOS, underwent clinical and laboratory assessments for the diagnosis of metabolic syndrome, as per international diabetes federation (IDF) criteria.

Results: 14.3% subjects had metabolic syndrome. The prevalence of individual components of the metabolic syndrome among PCOS patients were: waist circumference >80cms in 100%, HDL < 50mg/dl in 100%, triglycerides > 150mg/dl in 75%, blood pressure >130/85mmhg in 12.5%, fasting plasma glucose > 100 mg /dl in 87.5%. Subjects with metabolic syndrome had significantly higher BMI compared to those without metabolic syndrome (p=0.043).

Conclusion: The metabolic syndrome and its individual components, like waist circumference and decreased HDL were found to be more common among PCOS patients in this study. As the risk of MetS increases with age and BMI, early screening and timely interventions like lifestyle changes will prevent metabolic complications like cardiovascular diseases and type II diabetes mellitus.

1. Introduction

Polycystic ovarian syndrome is a common endocrinal pathology in women with a prevalence of about 5 to 15%.[1] American gynecologists Stein and Leventhal first described this syndrome in 1935 hence it is also called as Stein Leventhal syndrome.[2] Several long term and short term complications are noted in PCOS women including menstrual disturbances, infertility, Psychological stress and metabolic derangements. If not intervened earlier PCOS may also lead to cardiovascular diseases and diabetes mellitus in the future.[3] PCOS and metabolic syndrome share a common entity of insulin resistance. Prevalence of metabolic syndrome differs from region to region and it

is also associated with body mass index, gender, race and age.[4] Early identification and management of metabolic complications in PCOS patients will prevent long term cardio metabolic risks.[5] The objective of this study is to find the association between PCOS and metabolic syndrome.

Insulin resistance in PCOS is independent of adipose distribution and body mass index and it is due to the abnormal serine phosphorylation of the insulin receptors.[6] Hyperinsulinemia in PCOS is due to the dysfunction of pancreatic Beta cells which in turn causes increased androgen production and ovulatory dysfunction. Increased androgen production by both ovaries and adrenal gland leads to hyperandrogenism and its consequences.[7]

The clinical features of PCOS include menstrual irregularities, infertility, acne, hirsutism and alopecia.[8] The various criteria that are been used to diagnose polycystic

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ovary syndrome are Rotterdam criteria 2003 which is the commonly used criteria, National institute of health 1990 criteria, Androgen excess society criteria and national institute of health 2012 criteria.[9]

1.1. Rotterdam criteria 2003 (ESHRE/ASRM)[10]

1. Menstrual irregularity [Anovulation / Oligoovulation].
2. Features of hyperandrogenism [Clinical – features of hirsutism as assessed by Ferriman-Gallwey scoring and more than or equal to 8 and with or without acne or male pattern alopecia or total testosterone level in blood more than 60 ng /dl].
3. Ultrasonography of ovaries having more than equal to 12 follicles in each ovary with each follicle measuring a diameter of 2 to 9 mm or the volume of the ovary >10 ml[2].

Diagnosis of PCOS requires at least 2 of the above criteria to be fulfilled.

There are four phenotypes depending upon Rotterdam's criteria.[11]

Phenotypes	Parameters
A	Increased androgen levels (Hyperandrogenism) Anovulation or Oligo-ovulation USG features of PCOS
B	Increased androgen levels (Hyperandrogenism) Anovulation or Oligo-ovulation
C	Increased androgen levels (Hyperandrogenism) Polycystic Anovulation or Oligo-ovulation
D	Ovulatory dysfunction USG features of PCOS

Metabolic syndrome also called as syndrome X is a group of metabolic abnormalities like obesity, hypertension, elevated hypertriglyceridemia, elevated blood glucose and deranged lipid parameters.[12] PCOS may lead to development of atherosclerosis due to alteration of lipid parameters which in turn increases the risk of cardio metabolic diseases.[13] Various criteria are used to define metabolic syndrome like WHO (world health Organisation) criteria, IDF (international diabetes federation), NCEP (national cholesterol education program).[14]

1.2. International diabetes federation (IDF) 2006[15]

Waist circumference more than 80cms with the presence of at least two or more parameters given below:

1. Known diabetes or Blood glucose >100mg/dl
2. Already on drugs for low HDL or HDL cholesterol < 50mg/dl
3. Already on drugs for increased triglycerides or Sr.triglycerides >150mg/dl
4. On hypertensive treatment or BP >130/85 mmHg

2. Materials and Methods

This is a Hospital based cross-sectional study conducted on 56 women diagnosed with PCOS in the age group of 15 to 45 years who attended the Gynaecology OPD from September 2018 to June 2020. Institutional Ethical Committee approval was obtained.

2.1. Inclusion criteria

1. PCOS women diagnosed by Rotterdam criteria.
2. Age between 15 to 45 years.

2.2. Exclusion criteria

1. Pregnant women
2. Women with known Hypothyroidism, Hypertension, Hyperprolactinemia, Cushing's syndrome, Type I and Type II Diabetes mellitus and Hepatic or renal diseases.
3. Women on oral contraceptive pills, anti-diabetic drugs, antihypertensive drugs and lipid lowering drugs.

Informed written consent was obtained from the women with history suggestive of PCOS, and they were subjected to a detailed history including menstrual, medical, marital, obstetric and personal history. A complete physical examination was done for the presence of acne, Acanthosis nigricans, male pattern alopecia, hirsutism, height, weight, BMI, systolic and diastolic blood pressure, waist circumference, hip circumference and waist hip ratio. All the patients were screened for galactorrhoea (Hyperprolactinemia) and clinical examination for thyroid and Cushing's was done and ruled out. Hirsutism was assessed by modified Ferriman-Gallwey scoring and a score of more than or equal to 8 was considered to be hirsute. A thorough gynecological examination including per speculum and per vaginal examination was done. On day two of periods ultrasound was done to look for the features of PCOS and more than 12 peripherally arranged follicles each measuring 2-9mm in diameter or an ovarian volume >10cm[3] was considered to be PCO morphology.

On day two of menstrual cycle blood was collected for Fasting plasma glucose, Serum triglycerides, Serum HDL and Serum Total Testosterone. PCOS women were divided into four groups according to Rotterdam's PCOS phenotypes. Metabolic syndrome was diagnosed based on IDF criteria and it was studied in all phenotypes.

Data was analyzed using SPSS version 22. Chi-square test was used as test of significance for qualitative data. Continuous data was represented as mean and SD. Independent t test was used as test of significance to identify the mean difference between two quantitative variables. ANOVA (Analysis of Variance) was the test of significance to identify the mean difference between more than two groups for quantitative data.

3. Results and Observations

Table 1: Age parameters of PCOS

		Count	%
	<20 years	15	26.8%
	21 to 25 years	17	30.4%
Age	26 to 30 years	19	33.9%
	>30 years	5	8.9%
	Total	56	100.0%

In this study majority of subjects presented with complaints of menstrual irregularities (80.3%). In our study (25) 44.6% belonged to type A phenotype, (11)19.6% had type C and (20) 35.7% had type D phenotype.

Prevalence of Metabolic syndrome among PCOS subjects was 14.3%.
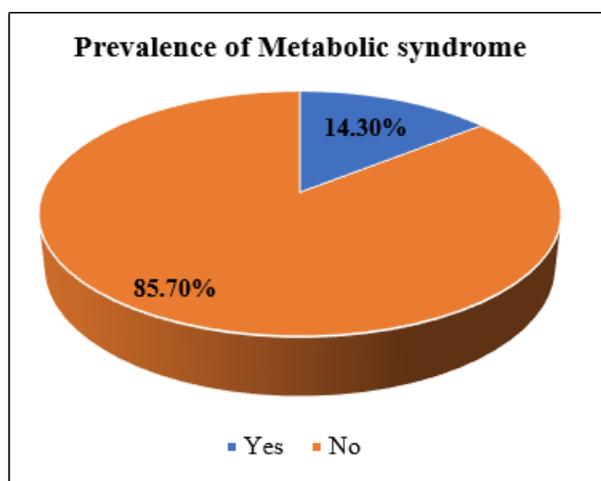
Fig. 1: Prevalence of Metabolic syndrome among PCOS subjects

In this study among Type A subjects majority were from Rural area (52%), among Type C subjects 54.5% were from semi-urban and among type D phenotype, majority were from semi urban area (50%). There was no significant association between type of phenotype and address. In this study among subjects with metabolic syndrome, majority were from semi urban area and among non-metabolic syndrome subjects, majority were from rural area. However there was no significant association between metabolic syndrome and location.

In this study among Type A phenotype, 12% had metabolic syndrome, among Type C phenotype, 18.2% had metabolic syndrome and among type D phenotype, 15% had metabolic syndrome. There was no significant difference in prevalence of metabolic syndrome with respect to Type of phenotype.

In this study among subjects with metabolic syndrome, 62.5% had Hirsutism and among non metabolic syndrome subjects, 45.8% had hirsutism. There was no significant association between metabolic syndrome and hirsutism. In this study among subjects with metabolic syndrome, 37.5% had increased testosterone and among non-metabolic syndrome subjects, 39.6% had increased testosterone. There was no significant association between metabolic syndrome and increased testosterone.

In this study there was significant association between metabolic syndrome and BMI, BP and FBS. There was no significant association between metabolic syndrome and other factors such as acne, acanthosis, WC, WHR, HDL and TGL.

In this study there was significant difference in mean SBP, DBP and FBS between subjects with Metabolic syndrome and without metabolic syndrome. In the study there was no significant difference in mean age, BMI, WC, HC, WHR, SBP, DBP, FBS, HDL and TGL between types of phenotype.

4. Discussion

Prediction of metabolic syndrome in PCOS women earlier in their disease process will prevent future cardiovascular problems and diabetes mellitus.

Metabolic syndrome had a prevalence of 14.3% in this study which is comparable to a study conducted by Madani et al.[16] which had a prevalence of 19.7%. The occurrence of MetS differs from region to region. A study conducted by Bhatacharya SM[17] in Indian PCOS population showed a prevalence of 47.5% of Metabolic syndrome whereas a study by Lal M et al.[18] showed a prevalence of 22%. This difference in prevalence is due to the variations in race and ethnicity and also due to the difference in criteria that was used for diagnosing metabolic syndrome.

There was no statistical significance noted in the prevalence of metabolic syndrome among various PCOS phenotypes. But Phenotype C (18.2%) had a higher prevalence of metabolic syndrome. The next common is Phenotype D which is 15% and phenotype A which is 12% whereas in a study by Sobti S et al.[19] the phenotype A (56%) had higher prevalence followed by other phenotypes. This variation is due to subjective differences in assessing the hirsutism.

In this study 20.83% of women with metabolic syndrome belonged to 26 to 35 years age group and 9.37% belonged to below 25 years. Varghese et al.[20] conducted a similar study which had a prevalence of 29.4% in 26 to 35 years and in a study by Madani et al.[16] below 25 years it was 9.5%. This implies the increase in age as an important risk factor to develop metabolic syndrome in PCOS women.

The prevalence of metabolic syndrome increases with BMI in our study. It was about 62.5% in obese PCOS women, 25% in overweight group and 12.5% in those women with normal BMI. Whereas in a study by Madani et al.[16] obese PCOS with metabolic syndrome were 46% and normal BMI category had 3.2%.

Table 2: Association between metabolic syndrome and Phenotype

| | | Phenotype | | | | | |
| | | Type A | | Type C | | Type D | |
		Count	%	Count	%	Count	%
Metabolic	Yes	3	12.0%	2	18.2%	3	15.0%
Syndrome	No	22	88.0%	9	81.8%	17	85.0%

$\chi^2 = 0.251$, df =2, p =0.882

Table 3: Association between metabolic syndrome and age

| | Metabolic Syndrome | | | | |
| Age group (years) | present | | absent | | Total |
	Count	%	Count	%	
< 25 years	3	9.37%	29	90.62%	32
26 to 35 years	5	20.83%	19	79.16%	24

Table 4: Association between Metabolic syndrome and various parameters

| | | Metabolic Syndrome | | | | | | |
| | | Yes | | No | | Total | | P value |
		Count	%	Count	%	Count	%	
Acne	Yes	3	37.5%	28	58.3%	31	55.4%	0.272
	No	5	62.5%	20	41.7%	25	44.6%	
Acanthosis	Yes	4	50.0%	17	35.4%	21	37.5%	0.430
	No	4	50.0%	31	64.6%	35	62.5%	
BMI	Underweight	0	0.0%	1	2.1%	1	1.8%	
	Normal	1	12.5%	15	31.2%	16	28.6%	
	Overweight	2	25.0%	24	50.0%	26	46.4%	0.043*
	Obese	5	62.5%	8	16.7%	13	23.2%	
WC	Normal	0	0.0%	8	16.7%	8	14.3%	0.212
	Abnormal	8	100.0%	40	83.3%	48	85.7%	
WHR	<0.85 Normal	2	25.0%	8	16.7%	10	17.9%	0.569
	>0.85 Abnormal	6	75.0%	40	83.3%	46	82.1%	
BP	Abnormal	1	12.5%	0	0.0%	1	1.8%	0.013*
	Normal	7	87.5%	48	100.0%	55	98.2%	
FBS	<100 Normal	1	12.5%	48	100.0%	49	87.5%	<0.001*
	>100 mg/dl Abnormal	7	87.5%	0	0.0%	7	12.5%	
HDL	>50 Normal	0	0.0%	5	10.4%	5	8.9%	0.339
	<50 Abnormal	8	100.0%	43	89.6%	51	91.1%	
TGL	<150 Normal	6	75.0%	44	91.7%	50	89.3%	0.158
	>150 Abnormal	2	25.0%	4	8.3%	6	10.7%	

All five parameters of metabolic syndrome were present in 1.78% in our study which is comparable to a study by Aghade et al.[21] in which it was 2.67%. Even in the absence of metabolic syndrome, PCOS women in our study fulfilled one (16.07%) or two (69.64%) features of IDF criteria. The common metabolic component in this study was Low HDL which is 100%. This is similar to a study conducted by Lal M et al.[18] in which 97% had low HDL. This shows the importance of lipid abnormalities especially decreased HDL cholesterol in the metabolic syndrome progression.

According to IDF criteria increased waist circumference is a compulsory parameter. In this study waist circumference was increased in 100% which is almost similar to a study by Varghese et al.[20] in which the prevalence was 86.6% whereas it was 26.7% in a study by Sobti S et al.[19] This is due to the various criteria that were used by each study and we have used IDF criteria in which increase in waist circumference is a must parameter.

Elevated fasting blood glucose is the third common parameter noted which was about 87.5% in our study whereas in a study conducted by Das et al.[22] it was 24.24%. Differences in ethnicity may be a reason for this variation.

Prevalence of increased triglycerides was 25% in our study which is same as that of a study by Das et al.[22] in

which it is 22.72%.

Hypertension is the last component in our study with a prevalence of 12.5% which is similar to a study by Mandrelle et al. [23] where it was 20%.

Serum testosterone values had no significant association with metabolic parameters in our study which is comparable to a study by Dumont et al. [24]

There are certain limitations for this study. Our study was conducted in a rural area with no BMI and age matched control. Accurate estimation of metabolic syndrome prevalence in PCOS could not be found out as it was done in a smaller study population. Further large scale studies are needed to exactly determine the association of metabolic syndrome and PCOS in the long run.

5. Conclusion

The prevalence of metabolic syndrome was found to be 14.3% in PCOS women. Even in the PCOS women without metabolic syndrome group most of them fulfilled at least one or two IDF criteria which make them highly susceptible to develop metabolic syndrome in the future. In this study decreased High density lipoproteins and increased waist circumference were noted in all PCOS women with metabolic syndrome. The next common finding that was noted is increased fasting blood glucose. These findings can be used to formulate a screening policy for MetS in PCOS women. Clinical examination and estimation of serum lipid profile can reduce the risk of progressing to cardiovascular complications and type 2 diabetes mellitus in PCOS patients. As the risk of MetS increases with age and BMI, early screening, proper health education and timely intervention like life style modifications including healthy diet and exercise are necessary in all PCOS women irrespective of age to prevent the late complications of metabolic syndrome.

6. Source of Funding

None.

7. Conflict of Interest

The author declares no conflict of interest.

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