



## A STUDY ON PREVALANCE OF METABOLIC SYNDROME IN POLYCYSTIC OVARIAN SYNDROME AND ITS PHENOTYPES

### Gynaecology

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### ABSTRACT

**Background:** Polycystic Ovarian Syndrome (PCOS) is a common gynaecological endocrinopathy characterized by chronic anovulation and hyperandrogenism. The disorder is heterogeneous and is one of the most common treatable causes of infertility. PCOS is characterized by insulin resistance with compensatory hyperinsulinemia. Insulin resistance also plays a role in the metabolic syndrome (MBS). Limited information is available pertaining to the prevalence of MBS in Indian PCOS women.

**Objective:** To study prevalence of MBS patients with PCOS in Indian women and its phenotypes.

**Materials and Methods:** Present study is a hospital based cross-sectional study carried out over a period of 12 months in department of Obstetrics and Gynaecology, Gauhati Medical College And Hospital, Guwahati, Assam, India. Total of 66 newly diagnosed case of PCOS as per Rotterdam Criteria(2003) were taken. MBS was defined according to American Heart Association /National Heart Lung Blood Institute AHA/NHLBI(ATP III 2005) definition.

**Results and Observations:** In the present study metabolic syndrome was found to be present in 36.37% of the study group. Of the 4 phenotypes of PCOS the classic type was most commonly associated with MBS and P+H type had least association with MBS seen in 62.5% and 4.17% respectively

**Conclusions:** PCOS women have high frequency of MBS. MBS are not only associated with the complete PCOs but also in other varieties of PCOS more so in obese than lean PCOS. So all PCOS patients need screening for all these problems when being evaluated in clinical practice.

### KEYWORDS

hirsutism, hyperandrogenemia, hyperinsulinemia, Oligomenorrhea

### INTRODUCTION

Polycystic ovary syndrome (PCOS) is the most common endocrinopathy in women of reproductive age with a prevalence of approximately 7-10% worldwide[1]. PCOS is a clinic-pathological syndrome characterized by anovulation or infrequent ovulation, obesity, hirsutism and numerous follicular cysts in enlarged ovaries. The discovery of the association of PCOS and insulin resistance was described first by Kahn and coworkers in 1976 [2] and Burghen *et al.* [3].

Currently, the commonest and widely accepted criteria used for the diagnosis of PCOS is the "Rotterdam criteria" May,2003 which includes any two of the following three features :

- 1)oligo/anovulation(O)
- 2)clinical and/or biochemical hyperandrogenemia(H)
- 3) polycystic ovaries on ultrasound(P), with exclusion of other known disorders of hyperandrogenemia.

This generates 4 types of phenotype[4];

- 1.P+H+O(PCOS complete)
- 2.P+O
- 3.H+O and
- 4.P+H

In PCOS women, metabolic disorders such as hyperlipidemia, insulin resistance, hypertension and type 2 diabetes mellitus in addition to increased risk of cardiovascular disease. These disorders are also the features of the so-called MBS or syndrome X, another cluster of endocrine disturbances. Since the anthropometric and metabolic abnormalities found in PCOS overlap with the components of MBS, the issue regarding MBS in women with PCOS has generated tremendous interest.

The present study was undertaken with an aim of finding the prevalence of MBS in Indian women with PCOS. Subgroups of lean and overweight women were studied separately for the prevalence of PCOS in its different phenotypes.

### MATERIALS AND METHOD

The study was carried out for a period of one year from 1<sup>st</sup> July 2016 to June 2017 among patients attending Gynaecology OPD of Gauhati Medical College and Hospital, Guwahati, Assam. It was a hospital based prospective cross-sectional study.

Total of 66 newly diagnosed case of PCOS using Rotterdam criteria were recruited. Detailed menstrual history, marital status, and parity recorded. Each subject underwent general and systemic physical examination. Anthropometric examination was also performed. Laboratory investigations of blood (biochemical and hormonal) and ultrasonography of pelvic organs was carried out. In patients complaining of amenorrhea, pregnancy was ruled out whenever necessary.

### INCLUSION CRITERIA

1.Women married or unmarried in age group 15-40 years of age were included.

### EXCLUSION CRITERIA

1. Pregnant women.
2. Women with age <15 and >40 years of age
3. Women with other causes of menstrual irregularity like hypothyroidism and hyperprolactinemia
4. Women with other causes of hyperandrogenism
5. Patients with known medical illness like diabetes or impaired glucose tolerance
6. Patients on medications like corticosteroids, oral contraceptives, metformin etc which could alter the endocrine and metabolic parameters under investigations.

Oligomenorrhoea was defined as an intermenstrual interval of  $\geq 35$  days or a total of  $\leq 8$  menses per year and amenorrhoea as absence of menstruation during last  $\geq 6$  months. Hyperandrogenism was assessed by both clinical and biochemical parameters. Hirsutism was used as a parameter for clinical hyperandrogenism. Hirsutism assessment was done using modified Ferriman-Gallwey (FG) score counting nine specified body areas by a single observer with a good reproducibility. A score of  $\geq 8$  out of total of 36 was taken as significant. Other features of clinical hyperandrogenism like acne vulgaris, androgenic alopecia were also recorded. Biochemical hyperandrogenism was defined as a

serum testosterone of >80 ng/dl. A thorough physical examination was performed including measurement of weight, height and waist circumference, hip circumference. Body mass index (BMI) was calculated using the formula:

$$BMI = \text{weight(kgs)} / \text{height}^2(\text{mts})$$

Cut-off body mass index (BMI) by Standard Consensus Statement for Indian population was considered, i.e., Normal BMI: 18.0-22.9 kg/m<sup>2</sup>, Overweight: 23.0-24.9 kg/m<sup>2</sup> Obesity: >25 kg/m<sup>2</sup> BMI ≥ 25 was considered as obese.

Patients with BMI <23 were classified as lean PCOS and those with BMI ≥ 23 as overweight PCOS. Central obesity was defined as waist:hip ratio >0.8.

Blood samples were taken from patients in a fasting state for fasting sugar (FBS), lipid profile(FLP),INSULIN level ,thyroid stimulating hormone (TSH) and prolactin(PRL) and 2 hrs after meal for post prandial sugar. For hormonal analysis leutinizing hormones(LH), follicle stimulating hormone (FSH), testosterone samples were collected on day3 to 7 of menstrual cycle or anytime in amenorrhoeaic patients.

A transabdominal ultrasonography was done in all cases to demonstrate the presence of more than 12 peripheral ovarian follicles arranged peripherally in necklace pattern ,each between 2-9 mm and/or ovarian volume >10 cm<sup>3</sup> suggestive of PCOS. Endometrial thickness was also documented.

Patients were evaluated for presence of Metabolic Syndrome using criteria given by AHA. In 2005, Metabolic syndrome was defined according to American Heart Association /National Heart Lung Blood Institute AHA/NHLBI(ATP III 2005) definition. It was defined if at least three of the following five features were present:

1. Female waist ≥80 cm
2. Triglycerides ≥150 mg/dL.
3. HDL cholesterol ≤50 mg/dL.
4. Blood pressure ≥130/85 mm Hg.
5. Fasting glucose ≥100mg/dL.

The higher the number of criteria present the higher the level of insulin resistance and its consequences

Data were analyzed using Fisher's exact test. P value < 0.05 was considered significant.

**RESULTS & OBSERVATIONS**

The results obtained are enlisted below:

**Anthropometric findings in PCOS**

In the study maximum patients 57.58% belonged to obese group according to their BMI and minimum patients 3.03% in underweight group. 28.79% had normal BMI and 10.6% in overweight group. Average BMI came out to be 25.51.

**Table 1: Showing classification of PCOS patients according to their BMI**

BMI	No. of patients	% of patients
<18(underweight)	2	3.03
18-22.9(normal)	19	28.79
23-24.9(overweight)	7	10.6
>25(obese)	38	57.58
Total	66	100

80.33 % of patients of PCOS were found to have central obesity as compared to 19.67% without central obesity. Mean waist:hip ration came out to be 0.86.

**Table 2: Central obesity in PCOS**

Waist:hip ratio	No. of patients	% of patients
≥0.82	53	80.33
<0.82	13	19.67
Total	66	100

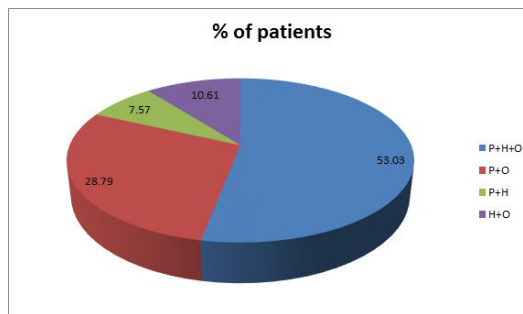
**Phenotypic classification of PCOS**

Of the three components in Rotterdam criteria for PCOS diagnosis most commonly found in the present study was oligomenorrhoea seen in 61 of 66 patients. Next was ultrasound picture of polycystic ovaries found in 59 patients and least was hyperandrogenism.

**Table 3: Components of Rotterdam criteria in PCOS**

Component	No . of patients	% of patients
Oligomenorrhea	61	92.42
Hyperandrogenism	47	71.21
Polycystic ovaries	59	89.39

In the present study maximum patients, 53.03%, belonged to classic type of PCOS and had all three criteria present followed by P+O group,28.79%. Minimum patients belonged to P+H group,7.57%.



**Figure 1: Showing Phenotypic classification of PCOS**

**METABOLIC SYNDROME IN PCOS**

Most commonly present component of Metabolic syndrome was found to be increased waist circumference seen in 46 of 66 patients. The mean waist circumference was 85.77cm. Next common was increased BP, 32 of 66 patients and mean was 122.73/79.39 mm of Hg. Least common was increased triglyceride levels, 15 of 66 patients.

**Table 4: Prevalence of components of metabolic syndrome in PCOS**

Component	No . of patients	% of patients
Waist circumference(WC)	46	69.7
Blood pressure(BP)	32	48.48
Fasting blood sugar(FBS)	16	24.24
Triglyceride (TG)	15	22.72
High density lipoprotein(HDL)	31	46.97

In the present study metabolic syndrome was found to be present in 24 of 66 patients comprising the 36.37% of the study group. Out of this 15 patients had 3 components present (22.72%) , 5 had 4 components (7.57%) and 4 had 5(6.06%) components present.

**Table 5:Prevalence of metabolic syndrome in PCOS**

Metabolic syndrome	No of patients	% of patients
Present	24	36.37
Absent	42	63.63

Of the 4 phenotypes of PCOS the classic type was most commonly associated with MBS and P+H type had least association with MBS seen in 62.5% and 4.17% respectively.

**Table 6: Metabolic syndrome in different phenotypic groups of PCOS**

Phenotype	No of patients	% of patients
P+H+O	15	62.5
P+O	6	25
H+O	2	8.33
P+H	1	4.17
TOTAL	24	100

Out of 21 lean PCOS patients 4 had metabolic syndrome and in 17 it was absent. Of 45 overweight PCOS MBS was present in 20 and absent in 25 patients. Using Fischer's t test p value was calculated as 0.0575 which is statistically not significant.

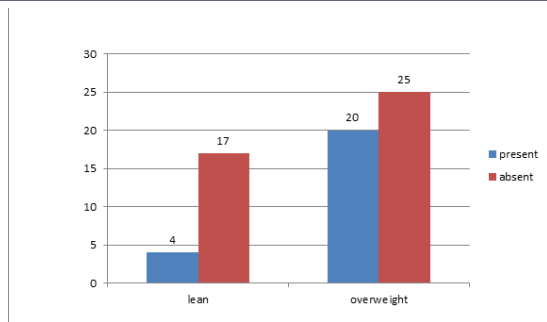


Figure 2: Metabolic syndrome in lean vs overweight PCOS.

**DISCUSSION**

In our study we looked for prevalence of metabolic syndrome in 66 newly diagnosed PCOS patients and compared the same among the four phenotypes of PCOS and among lean and overweight PCOS.

**METABOLIC SYNDROME AND PCOS**

In our study the most common component of MBS found was increased waist circumference, 69.7% followed by raised BP, low HDL, Raised FBS and increased TG as 48.48%, 46.97%, 24.24% and 22.72% respectively. Combining these components metabolic syndrome was found to be present in 24 of 66 patients comprising the 36.37% of the study group. Out of this 15 patients had 3 components present(22.72%), 5 had 4 components (7.57%) and 4 had 5 components present (6.06%).

In the study by Sujata Kar, the overall prevalence of metabolic syndrome among PCOS women was found to be 35.07% [5]. Mandrelle et al reported a prevalence of MBS as 37.5% in their study on 120 PCOS women. With three features in 24.2% cases, four features in 10% cases and all five features in 3.3% [6]. Sangita and Abha reported a prevalence of 39.16% of MBS in PCOS patients with significantly higher in obese subgroup 48.75% as compared to 20% in lean PCOS subgroup [7]. In the study by Carmina et al , Italy prevalence of MBS among 282 PCOS women was reported as 8.2% [8]. Dokras et al [9] and Glueck et al [10] of USA reported MBS in PCOS women as 47.3% and 46.4% respectively. In a recent retrospective study by Apridonidze et al, 2004 [11] 106 women with PCOS, the prevalence of PCOS and Metabolic Syndrome (n = 46) was 43%, nearly 2-fold higher than reported for age matched women in the general population.

TABLE 7: Prevalence of metabolic syndrome

STUDY	YEAR	COUNTRY	MBS%
Glueck et al	2002	USA	46.4%
Apridonidze et al	2004	USA	43%
Dokras et al	2005	USA	47.3%
Carmina et al	2006	Italy	8.2%
Mandrelle et al	2012	India	37.5%
Sujata Kar	2013	India	35.07%
Sangita and Abha	2015	India	39.16%
Our study	2017	India	36.37%

In our study we also compared the prevalence of MBS in different phenotypes of PCOS. It was seen that it was most commonly seen in classic type and least in P+H type. However studies by Kar [5], Shroff et al [12] and Mehrabian and co-workers [13] found hyperandrogenic phenotypes having higher prevalence of metabolic syndrome and least association between MBS and P+O phenotype of PCOS suggesting that P+O group of Rotterdam criteria have a mild metabolic profile.

On comparing prevalence of MBS in lean and overweight PCOS in our study it was found that 44.44 % of overweight(20 out of 45) and 19.04% of lean PCOS (4 out of 21) had MBS present. Kar [5] found obese women having higher prevalence of MBS compared to lean, 41 vs 13.3% which is similar to our study. Surprisingly, Shroff et al [12] reported not a single case of MBS in women with BMI < 30kg/m<sup>2</sup>. In our study lean PCOS women with MBS the major components were increased WC and low HDL cholesterol which as similar to study conducted by Kar.

The differences in the prevalences of MBS may be attributed to differences in body weight, dietary habits, lifestyle and genetic factors in different countries and ethnic group. Also different criteria for diagnosis of MBS like NCEP ATP III and International Diabetic Federation (IDF) criteria. The prevalence of MBS in PCOS in various Indian studies is however comparable with our study. MBS was found more prevalent among overweight PCOS than lean PCOS. Women with PCOS are at higher risk of developing MBS at an early age and lesser BMI as compared to non PCOS women. However our study had limitations of small number of cases and non-comparative study. Thus larger multi-centric studies with bigger sample size are required for further supporting the findings of our study. The major limitation of our study is the absence of control group which should be age and BMI matched to PCOS group.

**CONCLUSION:**

PCOS women have high frequency of MBS. 36.37% of cases in our study had MBS. Majority of those without MBS had atleast 1 component present putting them at risk to develop MBS if no intervention taken. MBS are not only associated with the complete PCOs but also in other varieties of PCOS more so in obese than lean PCOS. So all PCOS patients need screening for all these problems when being evaluated in clinical practice.

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