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## Original Research Article

## Study of occurrence of risk factors of metabolic syndrome in women with PCOS

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## ABSTRACT

**Background:** PCOS is one of the most common endocrine disorders of women in the reproductive age group. Metabolic syndrome is one of the major health issues currently to be focused on in young age group.

**Objectives:** To identify women with PCOS at risk of developing the metabolic syndrome and the association of individual metabolic parameters with PCOS.

**Materials and Methods:** A prospective observational study done in 132 non pregnant women aged 18-35 years diagnosed with PCOS using Rotterdam's criteria. Metabolic syndrome was diagnosed according to AHA/NHLBI (ATP III 2005) definition. Fisher's exact test and unpaired t test were applied for statistical analysis.

**Results:** Out of 132 women with PCOS, 31 met the criteria for Metabolic syndrome (23.5%) and 69.7% women had at least one risk factor out of the five criteria of Metabolic syndrome. Among those meeting criteria for MBS, the mean waist circumference ( $\geq 80$ cms) and mean BMI was found higher ( $p < 0.01$ ), and USG morphology of PCOS ( $p < 0.05$ ) than those who did not. Presence of acanthosis, SBP/DBP (130/85mmHg), FBS ( $\geq 110$ mg/dl), TG ( $\geq 150$ mg/dl), HDL ( $\leq 50$ mg/dl) were found in significantly greater number in those who met the criteria for MBS as compared to those who did not.

**Conclusion:** Women diagnosed with PCOS and also having features of increased BMI, WC ( $\geq 88$ cms), acanthosis are important risk factors for association of PCOS with Metabolic syndrome in significantly higher numbers and it is important to initiate screening for the same.

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## 1. Introduction

Polycystic ovarian syndrome (PCOS) is a poorly defined heterogeneous condition with a complex pathophysiology. It is one of the most common endocrine disorders affecting approximately 5–8% women of reproductive age group.<sup>1</sup> After the joint consensus, held at Rotterdam by ESHRE/ASRM in May 2003, the criteria for diagnosis of PCOS, has been well established.<sup>2</sup> Metabolic Syndrome is another group of endocrine abnormalities, including insulin resistance, dyslipidemia obesity and hypertension. It is

associated with a 2 fold increased risk of cardiovascular disease and a 5 fold increased risk of type 2 diabetes. The original National cholesterol education programme-Adult treatment panel III (NCEP-ATPIII) criteria 2001<sup>3</sup> defines metabolic syndrome as the co-occurrence of three or more of the following risk factors: Central obesity with waist circumference  $\geq 88$  cm in women, elevated systolic and/or diastolic blood pressure of  $\geq 130/85$  mmHg, impaired fasting serum glucose  $\geq 110$ mg/dl, elevated fasting serum triglycerides  $\geq 150$ mg/dl, Fasting high density lipoprotein HDL cholesterol  $< 50$  mg/dl.

PCOS is essentially a hormonal disorder characterized by insulin resistance and hyperandrogenism.<sup>4</sup> Obesity

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is common in PCOS and further aggravates insulin resistance.<sup>5</sup> In this setting, with both inherent PCOS related IR and obesity-related IR, the majority of women with PCOS are at risk of developing metabolic syndrome. This warrants a focus on metabolic health of women with PCOS and early detection and prevention of features of metabolic syndrome.

## 2. Materials and Methods

A prospective observational study was done at a tertiary care hospital in 132 non pregnant women aged 18-35 years diagnosed with PCOS in OPD of department of Obs & Gyne using Rotterdam's criteria. Metabolic syndrome was diagnosed according to AHA/NHLBI (ATP III 2005) definition. Other aetiologies that could mimic PCOS –Known cases of late-onset congenital adrenal hyperplasia, adrenal tumours, Cushing's syndrome, Pituitary adenoma, women with steroid or oral contraceptive drug intake in the preceding 3 months, previously diagnosed Diabetes I, previously diagnosed with any cardiovascular problems, known cases of Hyperprolactenemia, patients not willing for complete evaluation and patients. The main changes in the modified American heart Association/ National heart lung and Blood Institute definition (ATPIII 2005) include defining the ethnic specific difference in central obesity by using WHO recommendation for waist circumference  $\geq 80$  cms in Asian women and reducing threshold for impaired fasting glucose to 100mg% in accordance with the American diabetes Association revised definition. So WC cut off was taken  $\geq 80$  cms. Each patient had undergone a detailed clinical examination and a relevant laboratory evaluation. The study variables included age, menstrual pattern, Blood pressure (SBP/DBP), body mass index (BMI), waist circumference (WC), FG score, PCO pattern on ultrasound, fasting plasma glucose, fasting lipid profile. WC was measured at the midpoint between the lower margin of the least palpable rib and the top of the iliac crest using a measuring tape. Prevalence of Metabolic syndrome in the study population was the primary outcome. The Fischer's exact test and unpaired t test were used for Statistical analysis and significance for all analyses was defined as a two-tailed P value of less than 0.05. lost to follow up were excluded.

PCOS was defined by ESHRE/Rotterdam 2003 consensus as presence of any 2 out of 3 of the following: Oligo- and /or anovulation (Intermenstrual interval  $\geq 35$  days), Clinical and /or biochemical signs of hyperandrogenism (modified Ferriman Gallwey (FG) score for hirsutism  $\geq 8$  or acne and/or free testosterone exceeding upper limit in the respective laboratory, Polycystic ovaries on USG2. The updated diagnostic criteria at the time of review are based on a 2018 international consensus guideline.<sup>6</sup> In patients  $>8$  years post menarche, and using a high-frequency endovaginal probe: follicle

number per ovary (FNPO)  $\geq 20$ , and/or ovarian volume  $\geq 10$  mL, ensuring no corpora lutea, cysts or dominant follicles are present. If using transabdominal scanning, or older technology where ovarian morphology is not well visualized, consider using the ovarian volume threshold of  $\geq 10$  mL on either ovary. This supersedes the initial Rotterdam criteria 2 of  $\geq 12$  follicles and interim recommendations of 24 or 25 follicles per ovary.

Metabolic syndrome was defined as per the original National cholesterol education programme- Adult treatment panel III (NCEP-ATPIII) criteria 2001.<sup>3</sup>

## 3. Results

Out of 132 total numbers of confirmed subjects with PCOS, only 31 met the diagnostic criteria for MBS criteria, hence percentage prevalence of metabolic syndrome in PCOS is 23.5% and 69.7% women had at least one risk factor out the five of metabolic syndrome.

Age wise distribution showed 86 women were in 18-25 years age group and 46 women in  $>25$ -35 years age group and calculated percentage prevalence was 22.1% and 26.1% respectively (Table 1). This shows that there is slightly high prevalence in age group  $>25$ -35 years.

**Table 1:** Age wise percentage prevalence of MBS

Age (in years)	With MBS	Without MBS
18-25(n=86)	19 (22.1%)	67 (77.9%)
25-35 (n=46)	12 (26.1%)	34 (73.9%)
Total(n= 132)	31	101

Among those who met criteria for Metabolic syndrome, Waist circumference  $\geq 80$  cms and serum TGs  $\geq 150$ mg/dl were the most commonly deranged parameters in all 31(100%) women followed by HDL  $\leq 50$ mg/dl in 27(87%), FBS  $\geq 110$ mg/dl 26(83.8%) and SBP/DBP  $\geq 130 / 85$  mmHg in 19(61%) women (Table 2).

**Table 2:** Prevalence of individual components of the metabolic syndrome in PCOS women

Metabolic Parameter	Percentage
Waist circumference $\geq 80$ cm	31(100%)
HDL-cholesterol $<50$ mg/dl	27(87%)
Triglycerides $\geq 150$ mg/dl	31(100%)
Hypertension $\geq 130/85$	19(61%)
FBS $\geq 110$ mg/dl	26(83.8%)

Mean BMI (26.42) and mean waist circumference (84.82) were found higher in women with MBS than as compared to those who did not meet criteria for MBS with a significant p value  $< 0.01$ . Acanthosis nigricans were observed 87.1% of women in PCOS with metabolic syndrome group, which is significantly higher than 63.4% in PCOS group with p value  $< 0.05$  (Table 3).

**Table 3:** Comparison of different variables in PCOS women with and without the metabolic syndrome. (Values expressed in Mean  $\pm$ SD unpaired t test used)

Variables	Without MBS	With MBS	P value
% of subjects	77.09%	23.5%	
Age (yrs)	24.09 $\pm$ 3.76	24.84 $\pm$ 4.55	0.36
BMI (kg/m <sup>2</sup> )	21.67 $\pm$ 2.12	26.42 $\pm$ 2.39	<0.01
WC(cms)	80.35 $\pm$ 1.88	84.42 $\pm$ 2.63	<0.01
S. Triglycerides (mg%)	132.99 $\pm$ 8. 94	161.53 $\pm$ 5.19	<0.01
S.HDI (mg%)	54.72 $\pm$ 4.70	46.47 $\pm$ 4.22	<0.01

**Table 4:** Positive and negative predictive values of each component of the metabolic syndrome in PCOS women

Criteria for MS	No of PCOS subjects with criteria	No of PCOS subjects with criteria and MBS	Percentage of subjects with PPV	No of PCOS subjects without criteria	No of PCOS subjects without criteria and not MBS	Percentage of subjects with NPV
WC $\geq$ 80cms	92	31	33.6%	40	40	100%
Sbp/Dbp $\geq$ 130/85 mmHg	20	19	95%	112	100	89.28%
FBS $>$ 100 mg/dl	26	26	100%	106	101	95.52%
TG $\geq$ 150mg/dl	38	31	81.57%	94	94	100%
HDL $\leq$ 50mg/dl	40	27	67.5%	92	88	95.65%

**Table 5:** Hirsutism score in PCOS with and without metabolic syndrome

Hirsutism FG score > 8	PCOS with MS		Total
	No	Yes	
No	37(36.6%)	6(19.4%)	43(32.6%)
Yes	64(63.4%)	25(80.6%)	89(67.4%)
Total	101	31	132

p- value - 0.16 Fischer's exact test

Hirsutism was measured using a modified Ferriman Gallaway score at nine body sites, showing that out of 31 subjects with MBS in PCOS, 25 had FG score > 8 whereas 64 subjects in groups without MBS had the same. So hirsutism scores did not differ significantly in women with or without MBS.

#### 4. Discussion

Prevalence of metabolic syndrome in PCOS was 23.5%, which was low as compared to 42% in study conducted by Dey Ramprasad et al<sup>7</sup> and 33.4% according to study by Ehrmann et al<sup>8</sup> but as compared to study done by A.J. Goverde et al<sup>9</sup> (15.9%) it is higher. This difference in prevalence could be due to age group in our study (18-35) as in Dey Ramprasad et al<sup>7</sup> was 15-35 years. Also in our study we used the ethnic specific WHO recommendation for waist circumference  $\geq$ 80 cms in Asian women as cut off. The prevalence of metabolic syndrome was significantly associated with increasing BMI. The prevalence of Metabolic syndrome in Indians varies according to the region, the extent of urbanization, lifestyle patterns and cultural factors.<sup>10</sup> Among the individual

metabolic parameters waist circumference  $\geq$ 80cms and serum Triglyceride  $\geq$ 150mg/dl were the most commonly deranged parameters found in all 31 women who met the criteria for metabolic syndrome. Dey et al<sup>7</sup> found low HDL cholesterol and hypertension to be the most common parameters.<sup>7</sup> Each defining criterion was evaluated for its value to either confirm or exclude chances of MBS. In our study waist circumference above the threshold of 80 cm was found in all cases (100%) of metabolic syndrome which differs from study done by Dey Ramprasad et al<sup>7</sup> (34%) which used cut off value of 88cms. Also, when same is compared to study by Ehrmann et al<sup>8</sup> it was 80%. Misra et al. who had opined that lower cut-off points of WC for defining abdominal obesity might be more suitable for Asians than those suggested by NCEP, hence in this study 80 cms was used as cut off.

#### 5. Conclusion

Women with PCOS particularly those with increased BMI, WC ( $\geq$ 88cms), USG morphology of PCOS, acanthosis are important risk factors for association of PCOS with Metabolic syndrome in significantly higher numbers and

it is important to initiate screening for the same. From a clinical point of view, it may be questioned whether all women diagnosed with PCOS should be screened for metabolic abnormalities or whether screening for these abnormalities could be limited to only those women particularly at risk. It was found that a combination of waist circumference offers the best selection criterion for the screening of presence of metabolic syndrome in subjects with polycystic ovarian syndrome.

Also, on comparing different metabolic parameters, serum triglycerides was the most common abnormal parameter defining metabolic syndrome.

As the study comprises small sample size hence possibility of bias remains there, but observations and result still point out that there is significant risk of developing metabolic syndrome in women with PCOS. Waist circumference and serum triglycerides could be initial screening tools for women with PCOS to predict metabolic risk and thus institute early interventions to prevent long term sequel.

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

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