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Original Research Article

Prevalence of metabolic syndrome in women with polycystic ovarian syndrome: an observational study in a tertiary care centre in Pondicherry, India

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ABSTRACT

Background: Polycystic Ovarian Syndrome (PCOS) is a multifactorial, polygenic and multisystem endocrine disorder affecting women in reproductive age. PCOS diagnosis is based on 2003 Rotterdam criteria. It has been noted that hyperinsulinemia is a central factor in the pathogenesis of PCOS. Many studies show evidence of a critical link between PCOS and Metabolic Syndrome (MBS).

Methods: It was a hospital - based observational study done over a period of one year with a sample size of 177. An observational study was done in patients satisfying the inclusion and exclusion criteria. After taking informed and written consent, history was obtained from the patient to know the age, socioeconomic status, present and past clinical history, menstrual and obstetric history, personal and family history and any other history as deemed necessary. Patient was clinically assessed to know the height, weight, body mass index.

Results: The prevalence of MBS was 37.2%. The commonest age group was between 25- 35 years. There is no statistical association between educational qualification, economic status and the prevalence of MBS and There no significant association between the presence of acne, androgenic alopecia and the presence of PCOS. While the presence of increased waist circumference > 88cms, USG findings consistent with PCOS, high blood pressure > 130/85 mm of Hg, elevated FBS > 110 mg/dl, low HDL <50 mg/dl were statistically significant.

Conclusions: The results can be used to formulate a screening policy for metabolic syndrome, particularly in the low resource settings of developing countries.

Keywords: Hirsutism, Hypertension, Metabolic syndrome, Menstrual irregularities, Obesity, Polycystic ovaries

INTRODUCTION

Polycystic Ovarian Syndrome (PCOS) is a multifactorial, polygenic and multisystem endocrine disorder affecting 12-21% of women in reproductive age. PCOS diagnosis is based on 2003 Rotterdam criteria which is characterized by hyperandrogenism (clinical/ biochemical), menstrual irregularities (oligomenorrhoea, amenorrhoea and menometrorrhagia) and polycystic ovaries. According to

Rotterdam criteria PCOS is diagnosed in a woman who is having 2 out of above mentioned 3 criteria. A diagnosis made on the basis of above criteria estimates the prevalence of PCOS to be as high as 15 to 20 %. It has been noted that hyperinsulinemia is a central factor in the pathogenesis of PCOS.¹ Many studies show evidence of a critical link between PCOS and Metabolic Syndrome (MBS).¹⁻⁵ In recent years, MBS is diagnosed based on the International Diabetes Federation definition. This

definition consists of raised triglycerides more than or equal to 150 mg/ ml, HDL cholesterol less than 50 mg/ dl, raised blood pressure of 130/85 mm of Hg and raised fasting plasma glucose more than 100 mg/ ml. According to the new MBS definition, for a south east Asian woman to be defined as having MBS, she must have central obesity characterised by waist circumference >80 cm. In case BMI >30 kg/m², central obesity can be assumed, and waist circumference is not considered for the definition.

It is being observed in many Asian and Western studies that there is overlapping between PCOS and MBS. Both these syndromes are common risk factors for adult onset diseases like Type II diabetes mellitus and cardiovascular diseases.^{6,7,8} The knowledge of this demands the need to do further research on the prevalence of MBS in PCOS women and to measure the strength of their association in the Indian society. This will help us to make an attempt in modifying the lifestyle of affected women and thereby reduces the risk of long term sequelae.

METHODS

It was a hospital - based observational study done over a period of one year on 177 patients attending the OPD in SVMCH and RC. The following were the inclusion and exclusion criteria

Inclusion criteria

- All women irrespective of their parity
- History of irregular menses
- Presence of hirsutism
- Ultrasound diagnosis of PCOS
- Age between 15 to 35 years
- Women who have given their consent to be a part of this study

Exclusion criteria

- Pregnant women
- Age < 15 years or >35 years
- Women who are already diagnosed to have hypothyroidism, hyperprolactinemia, cushing's syndrome, non-classical – congenital adrenal hyperplasia
- Women who have not given their consent to be a part of this study

History was taken from the patient to know the age, socioeconomic status, present and past clinical history, menstrual and obstetric history, personal and family history and any other history as deemed necessary. Patient was clinically assessed to know the height, weight, body mass index, waist circumference and evidence of hyperandrogenism. Hyperandrogenism is assessed by the presence of acne, hirsutism (Ferriman-Gallaway score >8) and insulin resistance by acanthosis nigricans. The following biochemical investigations were done in all patients

- Triglyceride levels
- HDL
- Fasting glucose

The results of the investigations were organised into continuous and categorical variables and their association was identified using unpaired student t test. Chi square test was done and a P value of < 0.05 was considered as significant to arrive at the results.

RESULTS

The prevalence of MBS was 37.2%. The commonest age group was between 25-35 years. There is no statistical association between educational qualification, economical status and the prevalence of MBS. Table 1 shows among the 177 study participants majority were in the age groups of 25 to 35 years (54.2%).

Table 1: Age distribution among study participants.

Age	Frequency	Percent
15-25	81	45.8
26-35	96	54.2
Total	177	100

Table 2, more than 67% were completed their degree. 36.7% were completed their postgraduate / professional degrees followed 31.1% were undergraduate degrees.

Table 2: Educational status of study participants.

Education	Frequency	Percent
High School	27	15.3
HSC/Dip	30	16.9
UG	55	31.1
PG/Prof	65	36.7
Total	177	100

Table 3 shows that 47.5% were in Upper class and 35.6% were in upper middle class by modified Kuppusamy scale. 16.9% were in middle class and there were no lower socio-economic class participants.

Table 3: Socio economic status of study participants.

SES	Frequency	Percent
I	84	47.5
II	63	35.6
III	30	16.9
Total	177	100

The prevalence of central obesity with a waist circumference of >88cms was 37.3%. Table 4 explains that 66 (37.3%) study participants had waist circumference more than 88 cm, which signifies more than one third were in obese state. There was no significant association between the presence of acne,

androgenic alopecia and the presence of PCOS in present study.

Table 4: Distribution of waist circumferences among study participants.

Waist Circumferences	Frequency	Percent
Up to 88 cm	111	62.7
More than 88 cm	66	37.3
Total	177	100

Table 5 explains that prevalence of Metabolic Syndrome was 37.3% (i.e.) 66 out of 177 were diagnosed Metabolic Syndrome among study participants.

Table 5: Distribution of metabolic syndrome among study participants.

Metabolic Syndrome	Frequency	Percent
Present	66	37.3
Absent	111	62.7
Total	177	100

Table 6 explains that 81.9% were suffering with PCOS, HDLC was classified with cut off value 50; among participants 82 (46.3%) were had HDLC<50 and 95 (53.7%) had more than 50.

Table 6: Lab investigations details.

Features	Frequency	Percent
USG		
B/L PCOS	145	81.9
NAD	32	18.1
Total	177	100
HDLC		
<50	82	46.3
≥50	95	53.7
Total	177	100
FBS		
≤110	169	95.5
>110	8	4.5
Total	177	100
TGL		
<150	111	62.7
≥150	66	37.3
Total	177	100

Eight (4.5%) had more than 110 as fasting blood sugar value where in 95.5% had normal FBS. TGL was classified with cut off value 150, 66 (37.3%) had more than 150 and 111 (62.7%) had normal cholesterol level.

Table 7 describes that there was significant difference between mean Systolic blood pressure and Diastolic blood pressure between the cases and controls (p <0.01). Similarly, Triglycerides also had significant difference in metabolic syndrome (p=0.0001).

Table 7: Comparison of Metabolic syndrome with control in Lab findings.

	Metabolic Syndrome		t	p
	Present (n=66)	Absent (n=111)		
SBP	129.7±0.72	119.7±1.44	52.42	0.0001
DBP	88.97±1.01	80.13±1.3	47.4	0.0001
Tri-glycerides	182.8±11.24	122.29±9.79	37.6	0.0001
FBS	97.47±13.04	93.59±8.44	2.4	0.02

Table 8 explains that 87.8% of the cases had fasting level more than 110, which shows significant association between fasting blood sugar level with metabolic syndrome (chi sq = 11.42, p = 0.001).

Table 8: Association of metabolic syndrome with fasting blood sugar level.

FBS	Metabolic Syndrome			Chi sq	p
	Present	Absent	Total		
≤110	58 (87.8%)	111	169	11.42	0.001
>110	8 (12.2%)	0	8		
Total	66	111	177		

Table 9 explains that 84.8% of the cases had HDLC<50 wherein 76.6% with HDLC>50 in control, which shows significant association between HDLC with metabolic syndrome (chi sq = 60.36, p = 0.0001).

Table 9: Association of metabolic syndrome with HDL.

HDLC	Metabolic Syndrome			Chi sq	p
	Present	Absent	Total		
<50	56 (84.8)	26 (23.4)	82	60.36	0.0001
≥50	10 (15.2)	85 (76.6)	95		
Total	66	111	177		

Table 10 explains that 89.4% had metabolic syndrome among PCOS and 77.5% of control also had PCOS even then there was significant association between USG with metabolic syndrome (chi sq = 3.9, p = 0.04).

Table 10: Association of Metabolic syndrome with USG.

USG	Metabolic Syndrome			Chi sq	p
	Present	Absent	Total		
B/L PCOS	59 (89.4)	86 (77.5)	145	3.9	0.04
NAD	7 (10.6)	25 (22.5)	32		
Total	66	111	177		

Table 11 shows that there was no significant association between Androgenic Alopecia and metabolic syndrome (p = 0.8). Table 12 shows that there was no significant association between Acne and metabolic syndrome (p = 0.8).

Table 11: Association of metabolic syndrome with androgenic alopecia.

Androgenic alopecia	Metabolic Syndrome			Chi sq	P
	Present	Absent	Total		
Present	22	35	57	0.06	0.8
Absent	44	76	120		
Total	66	111	177		

Table 12: Association of metabolic syndrome with acne.

Acne	Metabolic Syndrome			Chi sq	P
	Present	Absent	Total		
Present	22	35	57	0.06	0.8
Absent	44	76	120		
Total	66	111	177		

Table 13 explains that 100% significant association between waist circumference with metabolic syndrome (chi sq = 172.7, p <0.01).

Table 13: Association of metabolic syndrome with waist circumference.

Waist circumference	Metabolic Syndrome			Chi sq	P
	Present	Absent	Total		
Up to 88 cm	0	111	111	172.7	0.0001
More than 88 cm	66	0	66		
Total	66	111	177		

Table 14 shows that there was no statistical association between Socio economic status with metabolic syndrome (chi sq = 2.2, p = 0.3).

Table 14: Association of Metabolic syndrome with SES.

SES	Metabolic Syndrome			Chi sq	P
	Present	Absent	Total		
I	34	50	84	2.2	0.3
II	19	44	63		
III	13	17	30		
Total	66	111	177		

Table 15 explains that 100% significant association between blood pressure with metabolic syndrome (chi sq = 172.7, p <0.01). Table 16 explains that 100% significant association between TGL with metabolic syndrome (chi sq = 172.7, p <0.01). The difference in fasting blood sugar level was statistically significant (p=0.02). USG findings were consistently associated with PCOS. 87.8% of the cases had fasting level more than 110, which shows significant association between fasting blood sugar level with metabolic syndrome (chi sq = 11.42, p = 0.001), 87.8% of the cases had fasting level more than 110, 31.6% had a high SBP of > 130mm of Hg while 37.3% had high DBP of > 85mm of Hg and there is a 100% significant association of high BP with PCOS.

Table 15: Association of Metabolic syndrome with BP.

BP	Metabolic Syndrome			Chi sq	P
	Present	Absent	Total		
Normal	0	111	111	172.7	0.0001
Elevated	66	0	66		
Total	66	111	177		

87.8% of the cases had fasting level more than 110, which shows significant association between fasting blood sugar level with metabolic syndrome (chi sq = 11.42, p = 0.001). 84.8% of the cases had HDL<50 wherein 76.6% with HDL>50 in control, which shows significant association between HDL with metabolic syndrome (chi sq = 60.36, p = 0.0001). Increased TGL > 150 mg/dl showed a 100% significant association with metabolic syndrome (chi sq = 172.7, p <0.01).

Table 16: Association of Metabolic syndrome with TGL.

TGL	Metabolic Syndrome			Chi sq	P
	Present	Absent	Total		
<150	0	111	111	172.7	0.0001
>=150	66	0	66		
Total	66	111	177		

DISCUSSION

Present study shows that 37.2% of women with metabolic syndrome had PCOS. This is closely related to the observations of 33.4% and 47.3% prevalence made by Ehrmann et al and Dokras et al respectively.⁹⁻¹³ The age adjusted prevalence of MBS has shown that women in between 25-35 years have the highest prevalence (54%) of MBS.^{14,15,16} Studies by Dey Ramprasad et al also shows a high prevalence of 71.5% in the same age group. More than 67% of women with PCOS had completed their degree, 36.7% were completed their postgraduate / professional degrees followed 31.1% had undergraduate degrees. Socio-economically 47.5% were in Upper class and 35.6% were in upper middle class by modified Kuppusamy scale, 16.9% were in middle class and there were no lower socioeconomic class participants. This shows that there was no statistical association between socioeconomic status and metabolic syndrome although it is believed that women with sedentary jobs belonging higher socioeconomic class are more prone for MBS. The prevalence of central obesity with a waist circumference of >88cms was 37.3%, which signifies that more than one-third were obese and there is 100 % significant association between MS and PCOS.^{17,18,19} This suggests that Indian women rather should have a different cut-off value for WC. Androgen excess may support the presence of an unfavorable metabolic state leading to dyslipidemia and central distribution of fat (android pattern). In obese women, excess insulin and androgens may contribute to the development of the PCOS and metabolic syndrome. The android pattern of fat distribution may be the result as well as the cause of

hyperandrogenism, setting up a vicious circle of hyperinsulinism, hyperandrogenism, central adiposity, and metabolic abnormalities. However, there was no significant association between the presence of acne, androgenic alopecia and the presence of PCOS in present study.

In present study, with a significant p value of 0.04, there was an association between USG findings and PCOS. This suggests that USG can be a helpful modality in diagnosing PCOS. 31.6% had a high SBP of > 130mm of Hg while 37.3% had high DBP of > 85mm of Hg and there is a 100% significant association of high BP with PCOS. 87.8% of the cases had fasting level more than 110, which shows significant association between fasting blood sugar level with metabolic syndrome (chi sq = 11.42, p = 0.001).

84.8% of the cases had HDL<50 wherein 76.6% with HDL>50 in control, which shows significant association between HDL with metabolic syndrome (chi sq = 60.36, p = 0.0001). Kavita et al have also found similar positive associations with a low HDL (<50 mg/dL) being seen in 91.7 % cases studied.²⁰

We found a 100% significant association between TGL with metabolic syndrome (chi sq = 172.7, p <0.01). Screening all women with PCOS for the positively associated factors would be ideal but this is not always practical, especially in a low-resource scenario. Identifying risk factors for screening would be an alternate strategy. Our results suggest that women having any of the following risk factors: age more than 25 or with central obesity waist-hip ratio >0.85, are at a greater risk of having the metabolic syndrome. However, the results need to be cautiously interpreted as the present study has certain limitations. The study was done at a tertiary care centre without use of a control group of non-PCOS women for comparison and the sample size was estimated taking a precision of 9% of the true value.^{21,22} A larger sample size will be required for a more precise estimate of the prevalence of metabolic syndrome. We were unable to find any published data from the Indian subcontinent using the modified AHA/NHLBI ATP III (2005) criteria; hence, comparison was impossible.

CONCLUSION

The prevalence of metabolic syndrome in present study was 37.2%, which constitutes more than a third of the women diagnosed with PCOS. This implies that it is mandatory to screen all the women with PCOS for features of metabolic syndrome. In present study, age >25 years and presence of central obesity (waist-hip ratio >0.85) were identified as risk factors for metabolic syndrome. There is a significant association of PCOS with high BP, low HDL levels, elevated FBS, high TGL and consistent USG findings. These results can be used to formulate a screening policy for metabolic syndrome,

particularly in low resource settings in developing countries.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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