Indian Journal of Clinical Practice, Vol. 31, No. 5, October 2020

# A Comparative Study to Analyze the Association of Metabolic Syndrome in Females with Diagnosed Polycystic Ovarian Syndrome

RICHA SINGH*, SAROJ SINGH*, POONAM YADAV†, HARPREET KAUR‡


## ABSTRACT

**Objectives:** Polycystic ovarian syndrome (PCOS) is a common female endocrinopathy affecting 5-6% of women within the age group 12-45 years. This study was contemplated with the aim to study the prevalence of metabolic syndrome in patients of PCOS and to study the spectrum of clinical features of metabolic syndrome in patients of PCOS. **Material and methods:** This case-controlled study was conducted on 50 cases of diagnosed PCOS females and compared with 50 healthy age and body mass index (BMI) matched controls. **Results:** The prevalence of metabolic syndrome in PCOS patients was found to be 24% and in control group it was 6%. Among patients with metabolic syndrome 14% of patients had high blood pressure, 12% had impaired fasting glucose, 38% had high waist-hip ratio, 14% had raised serum triglycerides and 44% had decreased high-density lipoprotein (HDL). **Conclusion:** It is observed that metabolic syndrome manifests at an early age in women with PCOS. In order to prevent metabolic syndrome one should maintain BMI <25 and waist circumference <35 inches.


**Keywords:** Metabolic syndrome, polycystic ovarian syndrome, hyperinsulinemia

Polycystic ovarian syndrome (PCOS) is one of the most common female endocrinopathies affecting 5-6% of women within the age group 12-45 years. These patients are at high-risk of developing infertility, dysfunctional uterine bleeding, endometrial carcinoma and a number of metabolic disorders including insulin resistance, hyperinsulinemia, type 2 diabetes mellitus, hypertension, dyslipidemia and cardiovascular disease. Due to these facts, early diagnosis of the syndrome should be emphasized.

This background knowledge demands the necessity to work out the prevalence of metabolic syndrome in women with PCOS in our society and to measure the strength of their association in the Indian scenario.

*Professor
†Lecturer
‡Jr - III
Dept. of Obstetrics and Gynecology
SN Medical College, Agra, Uttar Pradesh
**Address for correspondence**
Dr Richa Singh
Professor
Chauhan Nursing Home
1/120-G, Delhi Gate, Agra - 282 002, Uttar Pradesh
E-mail: chauhan.richavishal@gmail.com

## AIMS AND OBJECTIVES

- To study the prevalence of metabolic syndrome in patients of PCOS.
- To study the spectrum of clinical features of metabolic syndrome in patients of PCOS.

## MATERIAL AND METHODS

This study was conducted on 50 cases of diagnosed PCOS coming to our hospital and was compared with 50 healthy age and body mass index (BMI) matched women (control group) over a period of 1 year.

### Inclusion Criteria

Around 50 cases diagnosed to have PCOS by the Rotterdam European Society of Human Reproduction Embryology/The American Society of Reproductive Medicine (ESHRE/ASRM) PCOS group's revised 2003 criteria, with presence of any two of the three criteria, were recruited for the study. These criteria are:

- Oligo and/or anovulation
- Clinical and/or biochemical signs of hyperandrogenism
- Polycystic ovaries (as confirmed by USG)

**The criteria for metabolic syndrome in women with PCOS.**

According to National Cholesterol Education Program (NCEP), Adult Treatment Panel III (ATP III) 2001, three out of these five will qualify for the syndrome:

- Abdominal obesity (waist circumference ≥88 cm or 35 inches) and ≥80 cm for Asian females
- Triglycerides ≥150 mg/dL
- High-density lipoprotein (HDL) cholesterol ≤50 mg/dL
- Blood pressure ≥130/85 mmHg
- Fasting plasma glucose ≥100 mg/dL or previously diagnosed type 2 diabetes.

After taking careful history from the patient and conducting examination, following investigations were carried out - hemogram, fasting blood sugar, oral glucose tolerance test (OGTT), fasting insulin, fasting lipid profile, hormonal estimations for leuteinizing hormone, follicle-stimulating hormone, testosterone, estrogen, progesterone and ultrasound abdomen.

In these women, fasting blood was drawn for glucose, insulin and lipid profile, which included triglycerides, total cholesterol, HDL and low-density lipoprotein (LDL) cholesterol. A 2-hour 75 g glucose tolerance test was done in all PCOS patients.

Two markers for obesity, such as BMI and waist-hip ratio, which depict central obesity, were used to study the relationship of obesity to lipid parameters. Height (m) and weight (kg) measurements can be used to calculate the BMI (BMI = Weight in kg/height in $m^2$). Waist-hip ratio can be calculated after measuring waist circumference between pelvic brim and costal margin, while hip circumference is taken at the level of the greater trochanter. Waist-hip ratio >0.85 is considered abnormal, while <0.85 normal.

The results were subjected to statistical analysis wherever applicable.

## RESULTS

The profile of patients included in the study is shown in Table 1. The distribution of cases and controls according to BMI ($kg/m^2$) is shown in Table 2.

It is seen that 68% of patients included in the study were overweight or obese. Table 3 shows distribution of cases according to fasting insulin levels. Fasting insulin levels were raised in 24% of cases and 10% of controls.

**Table 1.** Patient Profile

| | Age group | | | Socioeconomic status | |
|---|---|---|---|---|---|
| | 15-25 | 26-35 | Total | Low | High |
| **Cases** | | | | | |
| No. | 21 | 29 | 50 | 20 | 30 |
| % | 42 | 58 | 100 | 40 | 60 |
| **Controls** | | | | | |
| No. | 16 | 34 | 50 | 22 | 28 |
| % | 32 | 68 | 100 | 44 | 56 |

P value < 0.04.

**Table 2.** Distribution of Cases and Controls according to BMI ($kg/m^2$)

| Category according to BMI ($kg/m^2$) | Cases | | Controls | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Underweight (≤19.9) | 3 | 6 | 2 | 4 |
| Normal (20-24.9) | 13 | 26 | 15 | 30 |
| Overweight (25-29.9) | 30 | 60 | 28 | 56 |
| Obese (≥30) | 4 | 8 | 5 | 10 |
| **Total** | **50** | **100** | **50** | **100** |

**Table 3.** Distribution of Cases according to Fasting Insulin Levels

| Category | Cases | | Controls | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Normal | 38 | 76 | 45 | 90 |
| Increased | 12 | 24 | 5 | 10 |

**Table 4.** Distribution of Cases according to Components of Metabolic Syndrome in Patients of PCOS

| Clinical components | Cases | | Controls | |
|---|---|---|---|---|
| | Positive | % | Positive | % |
| BP >130/85 mmHg | 7 | 14 | 2 | 4 |
| Impaired fasting blood glucose (>100 mg/dL) | 6 | 12 | 2 | 4 |
| Waist-hip ratio >0.85 cm | 19 | 38 | 7 | 14 |
| ↑S. TG (>150 mg/dL) | 8 | 16 | 5 | 10 |
| ↓HDL-C (<50 mg/dL) | 22 | 44 | 6 | 12 |

PCOS = Polycystic ovarian syndrome; BP = Blood pressure; S. = Serum; TG = Triglyceride; HDL-C = High-density lipoprotein cholesterol.

Distribution of cases according to components of metabolic syndrome in patients of PCOS is shown in Table 4. It was seen that ↓HDL-C levels were seen

**Table 5.** Comparative Evaluation of Clinical Spectrum of Metabolic Syndrome in Cases and Controls

| Clinical parameters | Controls (50) | Cases (50) | P value |
|---|---|---|---|
| Age (years) | 26 | 25 | 0.52 |
| BMI | 23.75 | 24.25 | 0.78 |
| SBP (mmHg) | 110 | 120 | 0.06 |
| DBP (mmHg) | 70 | 74 | 0.06 |
| S. cholesterol (mg/dL) | 175.2 | 201.2 | 0.02 |
| S. TG (mg/dL) | 110.7 | 133.3 | 0.03 |
| HDL (mg/dL) | 35.2 | 25.4 | 0.04 |
| LDL (mg/dL) | 105.2 | 130.8 | 0.04 |
| VLDL (mg/dL) | 12.2 | 18.12 | 0.02 |
| Insulin (μIU/mL) | 5.1 | 6.5 | 0.04 |
| Fasting glucose (mg/dL) | 77 | 86 | 0.04 |

ANOVA test is used for calculating p value.

BMI = Body mass index; SBP = Systolic blood pressure; DBP = Diastolic blood pressure; S = Serum; TG = Triglyceride; HDL = High-density lipoprotein; LDL = Low-density lipoprotein; VLDL = Very low-density lipoprotein.

**Table 6.** Prevalence of Metabolic Syndrome in Various Studies

| Study | Year | Prevalence of metabolic syndrome (%) |
|---|---|---|
| Our study | 2012-13 | 24 |
| Glueck et al (USA)[1] | 2003 | 43-46 |
| Dey (India)[2] | 2011 | 42 |
| Ehrmann et al[3] | 2006 | 33.4 |
| Dokras et al[4] | 2005 | 47.3 |

in 44% of cases and 12% of controls. Waist-hip ratio >0.85 cm was seen in 38% of cases and 14% of controls. Comparative evaluation of clinical spectrum of metabolic syndrome in cases and controls is depicted in Table 5. The prevalence of metabolic syndrome in various studies is shown in Table 6.

## DISCUSSION

This was a cross-sectional case-control study of 100 females attending our OPD over a period of 1 year.

If we compare BMI matched cases and controls, then also lipid profile derangement is associated more with PCOS obese than non-PCOS obese ($p < 0.04$). This is in accordance with the study of Macut et al[5] who found that overweight and normal weight women with PCOS have higher incidence of lipid profile derangement than their controls. Wild et al[6] found that dyslipidemia is more common in PCOS. In our study, among patients with lipid profile derangement, 44% had decreased HDL as compared to 12% of controls ($p < 0.05$). Low HDL is having more detrimental effect on lipid profile derangement predictions among cases, which is in accordance with a study in Teharian women by Moini et al,[7] where low HDL was found in 96.9% of cases of metabolic syndrome in PCOS. Study by Dey et al[2] showed decreased HDL in 50% cases. In our study, waist circumference, which depicts central obesity ≥80 cm was found in 38% of cases and 14% of controls ($p < 0.05$). It is different from the study done by Ehrmann et al,[3] which supports high value of waist circumference by citing 80% of subjects above 88 cm.

In our study, fasting insulin level showed increase in 24% of cases and 10% of controls ($p < 0.05$). It shows a significant difference among women with metabolic syndrome in comparison to those without metabolic syndrome as supported by Dokras et al[4] in 2005.

We observed that, while USA women and Indian women have similar androgen levels, similar blood pressure, similar total cholesterol and LDL, USA women have higher body weight, higher fasting insulin, higher fasting glucose level, lower HDL and raised triglycerides. Most of these differences occurred as a result of higher prevalence of obesity in USA group, but other factors including characteristics of diet may also be responsible.

Thus, in our study, prevalence of metabolic syndrome was 24% among cases and 6% among age and BMI matched controls, which shows a statistically significant difference ($p < 0.05$) and thus, PCOS, *per se*, is responsible for prevalence of metabolic syndrome.

## CONCLUSION

It is observed that metabolic syndrome manifests at an early age in women PCOS. Hyperinsulinemia, a central factor in the pathogenesis of PCOS, also appears to be a critical link between PCOS and metabolic syndrome. Thus, there is an urgent necessity to assess the rising trend of metabolic syndrome among the women with PCOS and to take early measures for primary prevention of its long-term sequel.

In order to prevent metabolic syndrome maintain BMI <25 and waist circumference <35 inches to prevent the development of metabolic syndrome or cardiovascular disease. An independent panel convened by the National Institutes of Health has recommended that well-designed, multicentric studies be conducted to determine factors such as obesity, that exacerbate a

genetic predisposition. The panel also determined the need for additional research to identify risks and treatments for complications and how to manage the common symptoms.

## REFERENCES


1. Glueck CJ, Papanna R, Wang P, Goldenberg N, Sieve-Smith L. Incidence and treatment of metabolic syndrome in newly referred women with confirmed polycystic ovarian syndrome. Metabolism. 2003;52(7):908-15.
2. Dey R, Mukherjee S, Roybiswas R, Mukhopadhyay A, Biswas SC. Association of metabolic syndrome in polycystic ovarian syndrome: an observational study. J Obstet Gynaecol India. 2011;61(2):176-81.
3. Ehrmann DA, Liljenquist DR, Kasza K, Azziz R, Legro RS, Ghazzi MN; PCOS/Troglitazone Study Group. Prevalence and predictors of the metabolic syndrome in women with polycystic ovary syndrome. J Clin Endocrinol Metab. 2006;91(1):48-53.
4. Dokras A, Bochner M, Hollinrake E, Markham S, Vanvoorhis B, Jagasia DH. Screening women with polycystic ovary syndrome for metabolic syndrome. Obstet Gynecol. 2005;106(1):131-7.
5. Macut D, Damjanovic S, Panidis D, Spanos N, Glisic B, Petakov M, et al. Oxidised low-density lipoprotein concentration - early marker of an altered lipid metabolism in young women with PCOS. Eur J Endocrinol. 2006;155(1):131-6.
6. Wild RA, Rizzo M, Clifton S, Carmina E. Lipid levels in polycystic ovary syndrome: systematic review and meta-analysis. Fertil Steril. 2011;95(3):1073-9.e1-11.
7. Moini A, Javanmard F, Eslami B, Aletaha N. Prevalence of metabolic syndrome in polycystic ovarian syndrome women in a hospital of Tehran. Human Reprod Med. 2012;10(2):127-30.


■■■■

### Corticosteroid Use Tied to Lower Risk of Condition Worsening in Non-ICU Patients with COVID-19 Pneumonia

- A study published in *PLOS ONE* has revealed that early use of moderate-dose systemic corticosteroids in patients admitted to the general ward with COVID-19 pneumonia complicated by acute hypoxic respiratory failure (AHRF) resulted in a significantly lower rate of the primary composite outcome of ICU transfer, intubation or in-hospital death.
- The single-center retrospective cohort study assessed 265 patients consecutively admitted to non-ICU wards with laboratory-confirmed COVID-19 pneumonia between March 16 and April 30, 2020.
- Overall, 205 patients who developed AHRF ($SpO_2/FiO_2$ ≤440 or $PaO_2/FiO_2$ ≤300) were included in the final study.
- The mean age of the patients was 57 years; 74.63% were male, 73.04% patients were of Hispanic ethnicity/race. Among these 205 patients, 29.27% received systemic corticosteroids.
- Patients received methylprednisolone (n = 29, 48.33%), prednisone (n = 10, 16.67%), hydrocortisone (n = 1, 1.67%) and dexamethasone (n = 20, 33.33%).
- Corticosteroid treatment was started at a median of 2 days (IQR, 1-5) following admission, on a median or equivalent dose of 80 mg/day (IQR, 60-107) of methylprednisolone (equivalent to 12 (IQR, 9-16) mg of dexamethasone) for a median duration of 5 days (IQR, 4-7).
- Among the 202 eligible patients, 13 (22.41%) patients in the corticosteroid cohort developed the primary composite outcome, compared to 54 (37.5%) patients in the noncorticosteroid group (p = 0.039). The adjusted hazard ratio (HR) for developing the composite primary outcome was 0.15 (95% confidence interval [CI], 0.07-0.33; p < 0.001).
- Early administration of moderate-dose systemic corticosteroid (oral or intravenous) for a shorter duration in COVID-19 viral pneumonia may not be as harmful as initially believed. Additionally, it may be more beneficial than shown by the RECOVERY trial, whose early results revealed that low-dose (6 mg) dexamethasone decreased the risk of death among COVID-19 patients who required oxygen, with or without invasive mechanical ventilation.

*With input from Dr Monica Vasudev*