

Assessment of Metabolic Syndrome in Women with Polycystic Ovarian Syndrome – A Cross-Sectional Study

Varnika Rastogi¹, Namrata Verma², Akanksha Srivastava³, Govind Kahar⁴

^{1,2,3,4}Assistant Professor, Department of Obstetrics and Gynaecology, G S Medical College and Hospital, Pilkhuwa, Uttar Pradesh

Received: 25-06-2022 / Revised: 25-07-2022 / Accepted: 30-08-2022

Corresponding author: Dr. Govind Kahar

Conflict of interest: Nil

Abstract

Background: Polycystic ovarian syndrome is a prevalent disorder among women of the reproductive age group. It results in an increased stress level in the body resulting in the rise of inflammatory markers. This leads to infertility, lipid derangement, risk of type 2 diabetes & atherosclerosis. Early screening is required for proper management & preventing the serious sequelae & reduce the disease burden. Thus, this cross-sectional study was undertaken to assess metabolic syndrome in women with the polycystic ovarian syndrome with the controls.

Material & Methods: This cross-sectional study recruited 100 women in the age range of 15-35 years who visited the Department of Obstetrics and Gynecology in G S Medical College and Hospital, Pilkhuwa, Uttar Pradesh from January 2022 to June 2022. Group, I included healthy women in the age range of 15-35 years having documented features of PCOS (according to Rotterdam criteria, 2003) (n=50) & Group II included controls (n=50). Patients were excluded if they had diabetes, hypertension, cardiovascular disease, or pregnancy. Fasting plasma glucose, Systolic blood pressure, diastolic blood pressure, Waist circumference, Serum triglyceride & HDL cholesterol were recorded (according to NCEP criteria).

Results: The mean age of the participants in Group I & Group II were 24.54±3.42 yrs & 26.23±6.71 yrs respectively. Thus, the mean age in Group I was lower than that of Group II but was not statistically significant (p>0.05). Waist circumference, SBP, DBP, fasting blood sugar & serum triglyceride levels were statistically significantly higher in Group I (p<0.05). HDL cholesterol levels were statistically significantly higher in Group II (p<0.05). In Group I, 71% of the patients had obesity, 76% presented with hyperandrogenemia, 94% with Oligo/amenorrhea, 15% had primary infertility, 9% had secondary infertility & 65% had polycystic ovaries on ultrasonography.

Conclusion: A positive association between polycystic ovarian syndrome and metabolic disorders in females has been demonstrated. The metabolic syndrome is common in polycystic ovarian syndrome, among women with hyperinsulinemia and obesity. Regular screening & timely intervention emphasizing the importance of a healthy lifestyle can prevent the development of metabolic disorders & polycystic ovarian syndrome in women.

Keywords: Polycystic ovarian syndrome, metabolic syndrome, obesity, hyperandrogenemia

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Introduction

Polycystic ovarian syndrome (PCOS) is the commonest cause of infertility worldwide affecting around 5-10% of women of reproductive age. [1] In India, the prevalence is 20-30% in adolescent women. [2] It is a common endocrine disorder with clinical presentation of hyperandrogenism, chronic anovulation, and polycystic ovaries. It can be observed in association with adiposity, insulin resistance, altered lipid profile & less commonly hypertension, thus can be considered a metabolic disorder also. [3]

Batra et al study in 2020, noted a statistically significant association between PCOS and metabolic syndrome with an odds ratio of 5.92. [4] It manifests in females with gynecological symptoms such as oligomenorrhea/amenorrhea, hirsutism, alopecia, and acne, etc. Interindividual variations occur in the clinical presentation of PCOS. [3]

Due to the changes in lifestyle & growing urbanization in developing countries like India, obesity & diabetes mellitus are on a rise. The ovaries are sensitive to impaired glucose intolerance leading to PCOS. Adolescent populations mostly visit medical treatment in the late stages of this syndrome, which can present with consequences of infertility. Thus an early diagnosis & prevention is required to ameliorate the serious sequelae & reduce the health burden of the country. [5]

Obesity gives rise to insulin resistance and compensatory hyperinsulinemia. [6] Insulin resistance occurs in adipose and skeletal muscle tissues but ovaries have been shown to remain relatively sensitive to insulin. A series of genes are responsible for this insulin resistance. [7] Insulin and insulin-like growth factor 1(IGF-1) with increased LH stimulation lead to thecal hyperplasia, increased androgen secretion, arrest of follicular development, and anovulation along with menstrual disturbances. The production of sex hormone binding globulin (SHBG)

and (IGF-1) is also reduced in the liver resulting in an increase in free available testosterone. The secretion of ovarian androgens is increased. [8] Central obesity & insulin resistance lead to an altered lipolytic response to insulin. Release of free fatty acids(FFA) from adipose tissues enters portal circulation, leading to a deranged lipid profile. [9] As a result HDL cholesterol is decreased & total triglycerides increase.

An increase in the activity of hepatic lipoprotein lipase causes the increased conversion of large lipoprotein particles to smaller atherogenic particles, which may be the cause of cardiovascular disease. Thus an early screening is required to detect PCOS and treat the multiple sequelae. [3]

Thus this cross-sectional study was undertaken to assess the metabolic syndrome in females with the polycystic ovarian syndrome and compare them with controls.

Material & Methods- This cross-sectional study recruited 100 women in the age range of 15-35 yrs who visited the Department of Obstetrics and Gynecology in G S Medical College and Hospital, Pilkhuwa, Uttar Pradesh from January 2022 to June 2022.

The patients were grouped as:

Group 1 - apparently healthy women in the age range of 15-35 years having documented features of PCOS (according to Rotterdam criteria, 2003) [10] (n=50)

Group 2- women having normal pelvic study (n=50)

Patients were excluded if they had diabetes, hypertension, cardiovascular disease, or pregnancy.

Rotterdam diagnostic criteria for PCOS [10] : (Any two criteria should be present)

1)Oligoovulation/anovulation (amenorrhoea/oligomenorrhoea),

2) Clinical and/or biochemical signs of hyperandrogenism (hirsutism/ acne/ alopecia/ elevated levels of free or total testosterone)

3) Polycystic ovaries on sonography

NCEP diagnostic criteria for metabolic syndrome [11]: Presence of any following three criteria

- 1) Fasting plasma glucose \geq 100 mg/dl
- 2) Systolic blood pressure (SBP) $>$ 130 mm of Hg/ diastolic blood pressure (DBP) $>$ 85 mm of Hg
- 3) Waist circumference $>$ 35 inches
- 4) Serum triglyceride \geq 150 mg/ dl
- 5) HDL cholesterol \leq 50 mg/dl.

The detailed nature of the study was explained to each participant and institutional ethics clearance is undertaken. A thorough clinical examination by an experienced gynaecologist was done. All the patients underwent assessment of age, weight, waist circumference, blood pressure & presence of metabolic syndrome (according to NCEP criteria). 5 ml of venous blood was collected & sent for biochemical estimation of fasting blood sugar, total cholesterol, High-Density Lipoprotein (HDL) & Triglycerides.

Statistical analysis

The collected data were tabulated and put in an excel spread sheet & put to statistical analysis. The data were expressed as mean and standard deviation & percentage. Association between the various parameters was analyzed using the Chi-square test. P value $<$ 0.05 was considered statistically significant.

Results

The mean age of the participants in Group I & Group II were 24.54 ± 3.42 yrs & 26.23 ± 6.71 yrs respectively. Thus, the mean age in Group I was lower than that of Group II but was not statistically significant ($p > 0.05$). Waist circumference, SBP, DBP, fasting blood sugar & serum triglyceride levels were statistically significantly higher in Group II ($p < 0.05$). HDL cholesterol levels were statistically significantly higher in Group II ($p < 0.05$). (Table 1)

Group I patients observed fasting blood sugar (FBS) levels greater than 100 mg/dl in 12 % of cases as compared to 3% in Group II. In Group I, 71% of the patients had obesity, 76% presented with hyperandrogenemia, 94% with Oligo/amenorrhea, 15% had primary infertility & 9% had secondary infertility. In 65% of patients, polycystic ovaries were observed on ultrasonography. (Fig 1)

Table 1: Comparable Characteristic in Group I & Group II

	Group I	Group II	P value
Age (yrs)	24.54 ± 3.42	26.23 ± 6.71	> 0.05
Waist circumference (inches)	36.41 ± 3.72	33.08 ± 2.78	< 0.05
SBP (mmHg)	127.78 ± 10.45	121.26 ± 6.2	< 0.05
DBP (mmHg)	83.65 ± 7.63	78.54 ± 5.61	< 0.05
Fasting blood sugar (mg/dl)	96.5 ± 10.86	91.4 ± 9.2	< 0.05
Serum triglycerides (mg/dl)	146.71 ± 27.84	129.5 ± 25.8	< 0.05
HDL Cholesterol (mg/dl)	43.78 ± 8.7	46.6 ± 7.3	< 0.05

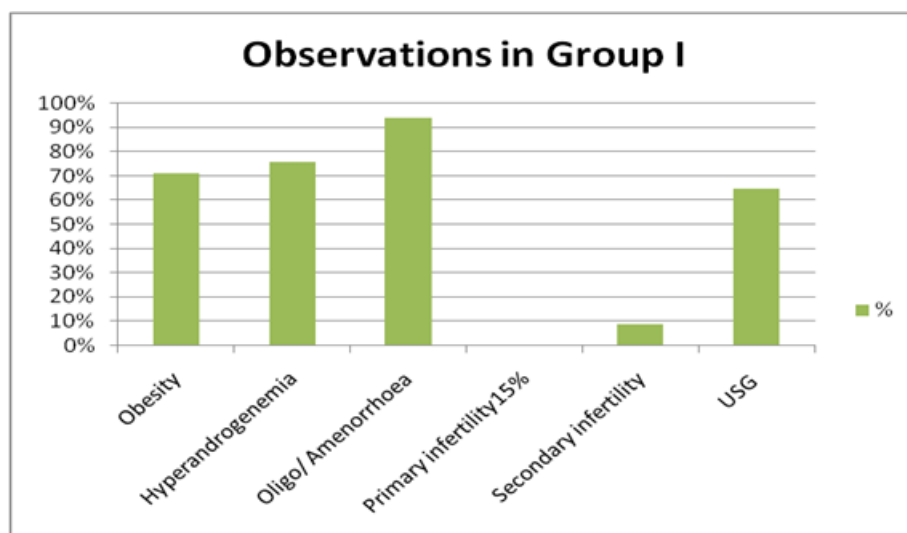


Figure 1: Observations in Group I Patients

Discussion

The metabolic syndrome can be evidenced in adolescent women with PCOS with no predilection irrespective of race and ethnicity. A contributing & central factor in the pathogenesis is hyperinsulinemia which has been demonstrated in several studies to be a critical link between metabolic syndrome & PCOS. [12] In the present study, demographic characteristics were comparable in both groups and no statistically significant difference was noted thus eliminating selection bias.

In the present study, women in Group I had central obesity with increased waist circumference (> 35 inches) which was statistically significantly higher (36.41 ± 3.72) as compared to Group II controls (33.08 ± 2.78 inch). Similar findings were observed in a study by Jeengar 2017 [3]. Batra et al 2020 [13] demonstrated abdominal obesity as measured by waist circumference > 88cm was found to be significantly associated with PCOS cases. The mean value in cases was 93.24 ± 11.66 and in controls was 85.10 ± 8.23 (p-value < 0.001).

Ehrmann et al 2006 noted that the prevalence of metabolic syndrome was higher (68%) in women aged 15-25 yrs than in 26-35 yrs (32%). This can be attributed to an urbanized lifestyle with

sedentary habits & poor dietary habits. Thus, obesity has a main role to play in the development of metabolic syndrome. Lifestyle modifications stressing the importance of a balanced diet, regular exercise & yoga practices can help modulate & prevent this syndrome. [13] Cheung et al demonstrated genetic factors, diet, and lifestyle habits influence the prevalence of metabolic syndrome in women with PCOS. [14]

In the present study, Group I patients observed fasting blood sugar (FBS) levels greater than 100 mg/dl in 12 % of cases as compared to 3% in Group I. This is consistent with the findings of Jeengar et al [3] & Glueck et al [15] where high FBS levels were observed in 11% & 12 % of patients resp. The findings suggest impaired glucose tolerance secondary to insulin resistance leading to metabolic syndrome in PCOS patients. Jamil et al have stated insulin resistance and central adiposity affect apparently healthy-weight females with PCOS & develop metabolic syndrome. Kayali et al 2021 showed increased testosterone levels, sex hormone binding globulin levels, fasting insulin levels & homeostatic model assessment of insulin resistance to be statistically significantly higher in the Group with the syndrome than in the controls. [16]

In the present study, Group I patients had higher mean triglyceride levels (146.71 ± 27.84) as compared to Group II (129.5 ± 25.8) ($p < 0.05$). 31% of patients in Group I & 29% of patients in Group II had higher triglyceride levels. Similar findings were observed in the Kiranmayee D et al study where hypertriglyceridemia was noted in 30% and 28% of cases and control respectively with no statistically significant difference. [17] No significant association was found between deranged lipid profile & PCOS.

Conclusion

A significant positive association is associated between metabolic disorders & PCOS. Education of women regarding significant metabolic risk factors associated with PCOS & long-term complications is the need of the hour. The importance of regular exercise & a healthy balanced food diet should be highlighted. Consumption of fast foods & processed foods should be avoided. A regular follow-up & maintenance of normal body weight can help reduce the inflammatory factors/cytokines and thus can keep a check on the development of hyperandrogenemia, increased blood sugar levels, hypertriglyceridemia & atherosclerotic sequela.

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