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Original Research Article

The prevalence of insulin resistance in polycystic ovarian syndrome cases at a tertiary care hospital: a cross sectional study

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ABSTRACT

Background: Insulin resistance (IR) is defined clinically as the inability of a known quantity of exogenous or endogenous insulin to increase glucose uptake and utilization in an individual as much as it does in a normal population. PCOS is a disease of heterogeneous disturbance of reproductive, endocrine and metabolic functions. The objective of the study was to study the prevalence of insulin resistance in polycystic ovarian syndrome cases.

Methods: The present cross sectional study was carried out at Obstetrics and Gynecology department, MGM medical college, Kalamoli, Navi Mumbai for a period of 2 years from 2011 to 2013 on total of 50 women aged between 16-39 years, coming to OPD with complaints of menstrual irregularities, infertility or hirsutism. After initial assessment, pelvic ultrasonography was done in these women to confirm the diagnosis of polycystic ovaries.

Results: Majority 26 (52%) cases were in age group of 16-25 years and, majority 19 (38%) cases were in overweight (25-29.99) group. There were 21 (42%) women with insulin resistance. When chi square test was applied to assess the association between BMI and insulin resistance, it was found to be statistically significant. ($p=0.01$).

Conclusions: The prevalence of abnormal glucose tolerance, dyslipidemia, insulin resistance and metabolic syndrome was observed to be high in PCOS. We conclude that physician should consider that early recognition to reduce the incidence and severity of associated potential sequelae.

Keywords: PCOs, Insulin resistance, Metabolic syndrome, infertility, BMI

INTRODUCTION

Polycystic ovary syndrome (PCOS) is a complex endocrine disorder that occurs in 1.14% to 11.04% of adolescent girls globally.¹⁻³ The diagnostic criteria for PCOS in adolescence include the combination of menstrual irregularities according to time since menarche and clinical or biochemical hyperandrogenism but only after excluding other causes.⁴⁻⁸ Pelvic ultrasonography is not recommended for PCOS diagnosis in girls who are less than 8 years since menarche according to international evidence-based guidelines, because it is associated with

over-diagnosis of PCOS.^{9,18} Insulin resistance and compensatory hyperinsulinemia are present in 44% to 70% of women with PCOS, suggesting that they have chances of developing type II diabetes mellitus.^{10,11} although PCOS is associated with a range of conditions that are related to obesity, the association of PCOS with obesity is not well understood. PCOS is more common in adolescents with obesity, yet insulin resistance is at times present in patients with PCOS regardless of their body mass index (BMI). The present study was conducted to study the prevalence of insulin resistance in polycystic ovarian syndrome cases at a tertiary care hospital.

METHODS

The present cross-sectional study was carried out at Obstetrics and Gynecology department, MGM medical college, Kalamboli, Navi Mumbai for a period of 2 years from 2011 to 2013. Ethical committee clearance was obtained from institutional ethics committee before commencing the study. A total of 50 women aged between 16-39 years, coming to OPD with complaints of menstrual irregularities, infertility or hirsutism were included in the study. Informed consent was taken before enrolling women in the study. Women above 40 years, women with menorrhagia, on medications such as steroids or OCPs, presently pregnant, and with any serious systemic illnesses were excluded from the study. A detailed family history and personal history was taken. All women were assessed by a single investigator to exclude bias.

After initial assessment, pelvic ultrasonography was done in these women to confirm the diagnosis of polycystic ovaries. Ultrasonography was done using trans-abdominal probe of 3.75 MHz frequency and transvaginal probe of 6 MHz frequency. TAS or TVS was done as per basis of merit. Unmarried women underwent Trans-abdominal Sonography. The diagnosis of PCO was established using the European Society for Human Reproduction and Embryology and the American Society for Reproductive Medicine (i.e. Rotterdam 2003 criteria).¹² The diagnosis was confirmed by 2 of 3 criteria: oligo and/or anovulation, features of hyperandrogenism (clinical and/or biochemical) with exclusion of any other etiologies of androgen excess, polycystic ovaries-Transvaginal ultrasonography (TVS) showing 12 or more follicles of 2-9 mm diameter in or both ovaries and / or increased volume > (10 cm³) is ultrasound feature of PCO.

To evaluate the insulin resistance, fasting serum insulin samples were taken along with fasting blood sugar samples. Plasma insulin was measured using ELISA specific for intact insulin. Cross reactivity of insulin assay for pro-insulin was less than 0.1%. Insulin resistance was measured using methods such as: fasting hyperinsulinemia with fasting insulin levels higher than 17μ IU/ml. FBS:Insulin ratio >4.5 was diagnosed as insulin resistance.

HOMA was applied and was calculated from fasting insulin and glucose concentrations.

$$HOMA = 22.5 \times 18 \div \text{fasting insulin} \times \text{fasting glucose}$$

Metabolic parameters were assessed by OGTT (oral glucose tolerance test) and overnight fasting lipid profile. Clinical evaluation was done by assessing the blood pressure, waist hip ratio and body mass index (BMI). Endocrinological parameters like serum testosterone, TSH, prolactin were measured on day 2-3 of menstrual cycle for confirming the diagnosis of PCO.

Statistical analysis

All data were analyzed with Statistical package for social sciences (SPSS) software version 26. Quantitative data was represented in numbers and percentages. Chi square test was used to see the association between the independent variables. P<0.05 was considered statistically significant.

$$HOMS - IR = \left(\text{glucose in } \frac{\text{mg}}{\text{dl}} \times 0.05551 \right) - \text{insulin in } \mu\text{U/ml} \div 22.5$$

$$HOMA - \% \beta \text{ cell} = (20 \times \text{insulin in } \frac{\mu\text{U}}{\text{ml}} \div \text{glucose in } \frac{\text{mg}}{\text{dl}} \times 0.05551) - 3.5$$

Glucose and insulin are fasting plasma values. Glucose in the formula is in mmol/l (mg/dl x 0.05551), and insulin is in μU/ml.

RESULTS

Out of 50 women included, majority 26 (52%) cases were in age group of 16-25 years followed by 24 (48%) in age group of 26-39 years.

Table 1: Distribution of cases according to age.

Age group (years)	No. of cases	%
16-25	26	52
26-39	24	48
Total	50	100

Table 2: Distribution of cases according to BMI.

BMI	No. of cases	%
<18.5	03	6
18.5-24.99	18	36
25-29.99	19	38
30-39	10	20
Total	50	100

Out of 50 women included, majority 19 (38%) cases were in overweight (25-29.99) group followed by 18 (36%) in normal BMI (18.5-24.99) group. there were 10 (20%) cases in obese (30-39) group. Maximum 45 (90%) cases had normal GTT and 04 (8%) cases with impaired GTT. Only one case had diabetes mellitus.

Table 3: Distribution of cases according to glucose tolerance test results.

GTT	No.of cases	%
Normal	45	90
Impaired	04	8
Diabetes mellitus	01	2
Total	50	100

Table 4: Distribution of cases according to presence of insulin resistance.

Insulin resistance	No. of cases	%
Yes	21	42
No	29	58
Total	50	100

Out of 50 women, 21 (42%) women had insulin resistance and rest 29 (58%) had no insulin resistance.

Table 5: Association between BMI and insulin resistance.

BMI	Insulin resistance		Total
	Yes	No	
<18.5	00	03	03
18.5-24.99	04	14	18
25-29.99	10	09	19
30-39	07	03	10
Total	21	29	50

Table 6: Association between BMI and glucose tolerance results.

BMI	Glucose tolerance results			Total
	Normal	Impaired	Abnormal	
<18.5	03	00	0	03
18.5-24.99	16	02	0	18
25-29.99	18	01	0	19
30-39	08	01	1	10
Total	45	04	1	50

Among 21 cases of insulin resistance, 10 cases had BMI between 25-29.99 and 7 cases had BMI between 30-39. When chi square test was applied to assess the association between BMI and insulin resistance, it was found to be statistically significant ($p=0.01$).

Among 45 cases with normal glucose tolerance test, 18 cases were with BMI of 25-29.99 and 16 cases were with BMI of 25-29.99 and 30-39 respectively. And in one case with abnormal glucose tolerance, BMI was in range of 30-39. When chi square test was applied to assess the association between BMI and glucose tolerance test results, it was not found to be statistically significant ($p=0.4$).

DISCUSSION

The present study was carried out in Obstetrics and gynecology department of MGM medical college, Navi Mumbai. In our study, 52% cases were in age group of 16-25 years followed by 24 (48%) in age group of 26-39 years. A study conducted by Madhusudhan et al maximum

(43.5%) number of women were in the 25 to 29 age group which is higher than present study.¹³

In present study, 38% women were overweight and 36% cases were obese. Similar results were seen in study carried out by Iftikhar et al.¹⁴ Goodarzi et al in their study on Mexican-American women with PCOS found that the mean BMI was higher in those with PCOS (34.2) than those without PCOS (34.2 versus 29.1, $p<0.03$); however, multiple logistic regression analysis of age, BMI, but not BMI was an independent significant predictor of PCOS ($p<0.05$).¹⁵ Joshi et al discussed that PCOS cases were on the higher scale of the normal range for biochemical parameters, especially obese PCOS had higher mean values compared with their lean counterparts suggesting more chances of metabolic syndrome in them.¹⁶ A contrast finding was seen in Balaji et al findings where majority cases had normal BMI.¹⁷

In glucose tolerance testing, 1 case was diagnosed with diabetes mellitus and 4 cases were diagnosed with impaired glucose tolerance. David et al characterized the prevalence and incidence of glucose intolerance in a large cohort of women with well characterized PCOS.¹⁸ Glucose tolerance was abnormal in 45% cases and 35% had IGT and 10% had NIDDM at the time of initial study. In present study, 94% cases had abnormal waist hip ratio. Mandrelle et al evaluated the metabolic syndrome in women with PCOS and found strong association between abnormal waist hip ratio and presence of PCOS and metabolic syndrome.¹⁹

The overall prevalence of metabolic syndrome in present study was 37.5% and dyslipidemia was seen in 93.3% cases of PCOS. Among all risk factors, age and waist hip ratio ≥ 0.85 were strongly associated with presence of metabolic syndrome. Also insulin resistance was statistically significantly higher in age group of 26-39 years. A case control study by Jefout et al²⁰ found insulin resistance (83.6%) was more common among the cases of PCOS compared to the control group ($p<0.001$).

Our study confers that insulin resistance, hyperandrogenism, and the severity of PCOS can be improved through lifestyle modification (LSM), such as dietary modifications, physical exercises, or behavioral changes, medications, such as metformin, or bariatric surgery will improve the body composition, hyperandrogenism and IR in women with PCOS. Weight loss has positive effects on the clinical improvement in menstrual function, fertility, pregnancy outcomes, and endocrine parameters.²¹

CONCLUSION

The study justifies the elaborate evaluation of metabolic and clinical parameters in patients with polycystic ovarian syndrome. The prevalence of abnormal glucose tolerance, dyslipidemia, insulin resistance and metabolic syndrome was observed to be high in PCOS. We conclude that

physician should consider that early recognition to reduce the incidence and severity of associated potential sequelae. Screening for impaired glucose tolerance and diabetes by determining serum glucose after 2 hours of 75 grams dextrose particularly in obese women and those with family history of type 2 DM. Clinicians today must address the patient's immediate symptoms/concerns and must also be mindful of the potential long-term consequences including diabetes and cardiovascular diseases.

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

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