Content available at: https://www.ipinnovative.com/open-access-journals

Indian Journal of Obstetrics and Gynecology Research

Journal homepage: www.ijogr.org

Original Research Article

Long-term implications of polycystic ovary syndrome (PCOS): An in-depth study on associated health risks and complications

Alka Rai[1], Akanksha Gupta[1], Sanjeev Kumar Yadav[2]*, Rinki Kumari[3]

[1]*Dept. of Obstetrics & Gynaecology, Chandan Hospital, Lucknow, Uttar Pradesh, India*
[2]*Dept. of Pathology, Hind Institute of Medical Sciences, Sitapur, Uttar Pradesh, India*
[3]*Advanced Centre for Traditional and Genomic Medicine, Institute of Medical Sciences, Banaras Hindu University, Uttar Pradesh, India*

ARTICLE INFO

Article history:
Received 19-07-2024
Accepted 24-09-2024
Available online 15-02-2025

Keywords:
PCOS
Insulin resistance
Cardiovascular disease
Infertility
Metabolic syndrome

ABSTRACT

Background: Polycystic ovary syndrome (PCOS) is a most common clinical-hormonal women-affecting disorder, often leading to chronic health issues beyond reproductive challenges. Women with PCOS experience irregular menstrual cycles along with elevated androgen levels; however, also associated with a high risk of chronic clinical-conditions such as Type 1 and Type 2 diabetes, and cardiovascular disease (CVD) due to underlying metabolic disturbances. This study investigates the health risks and complications associated with PCOS, including diabetes, cardiovascular disease, and fertility problems, aiming to develop improved management strategies.

Materials and Methods: This cross-sectional study was performed with 200 PCOS-diagnosed women and three hundred age-matched controls without PCOS. Data was collected from different sources like- Medical records, Laboratory tests, and Interviews with patients, and also from Body mass index(BMI), Blood glucose, Insulin levels, Cholesterol profile, C-reactive protein(CRP), Menstrual history, and Cardiovascular health markers. Statistical analysis was performed to compare the two groups through SPSS 20.0.

Results: The study revealed significantly higher rates of insulin resistance (72% vs. 25%) and Type 2 diabetes (35% vs. 10%) among PCOS-women. Additionally, CVD risk factors including hypertension (45% vs. 20%), abnormal cholesterol levels (60% vs. 30%), and elevated CRP levels were more prevalent in the Group I. Fertility issues were also more common in the Group I (with 80% experiencing anovulation and 50% reporting infertility) compared to 10% in the Group II.

Conclusion: PCOS is a significant clinical-risk factor for many types of diseases like Diabetes, CVD, infertility, etc. Effective management requires a comprehensive approach involving lifestyle modifications, medications, and regular screening and monitoring of PCOS to reduce risks of disease and also improve the health of women with PCOS.

1. Introduction

Polycystic ovary syndrome (PCOS) is a most common "Hormonal women disorder" affecting 5-10% of women of their reproductive age.[1] Traditionally linked to fertility challenges due to irregular ovulation; however, it is now recognized as a complex metabolic disorder condition with a range of health implications.[2]

A primary concern for women with PCOS-associated risk of Type-2 diabetes (T2DM), is often considered a "Hallmark" of the condition.[3] Insulin-resistance (IR) is a core feature of PCOS, hindering the body's ability to effectively use insulin, leading to blood sugar control difficulties. This metabolic dysfunction can ultimately result

* *Corresponding author*.
E-mail address: rinkiv3@gmail.com (S. K. Yadav).

https://doi.org/10.18231/j.ijogr.2025.014

in T2DM.[4] Regular blood sugar monitoring and lifestyle adjustments, including weight management and increased physical activity, are crucial for women with PCOS to improve insulin sensitivity.[5]

PCOS also significantly elevates the risk of CVD, due to the involvement of these factors like IR, inflammation, and abnormal cholesterol levels.[6] Chronic inflammation, often associated with insulin resistance, is a well-established CVD risk factor. Additionally, PCOS can lead to an adverse cholesterol profile with elevated LDL ("bad") cholesterol and reduced HDL ("good") cholesterol levels, further increasing the risk of heart disease and stroke. Early detection of these risk factors through regular health screenings is essential for prevention. Lifestyle modifications, such as a heart-healthy diet, regular exercise, and stress management, can help mitigate CVD risk.[7]

Effective PCOS management requires a comprehensive approach - maintaining a healthy weight through a 'Balanced diet' with rich in fruits, vegetables, and whole grains, essential for PCOS management.[8] At least thirty minutes of regular physical activity or workout (Moderate-intensity exercise) most days of the week can improve insulin sensitivity along with overall health.[9] Medications may be necessary to address specific PCOS symptoms, such as birth control pills for menstrual regulation, metformin for insulin resistance, or topical treatments for acne or excessive hair growth.[10,11] For women with PCOS desiring pregnancy, fertility treatments like ovulation-inducing medications or In-vitro fertilization (IVF) may be considered.

This study aims to deepen our understanding of the long-term women's health significances of PCOS (particularly T2DM, CVD, and also infertility). By comprehensively examining these risks, we seek to develop more effective management strategies to improve the whole health and well-being of women with PCOS.

2. Materials and Methods

2.1. Study design and population

This investigation employed a cross-sectional research design conducted over two years. Participants were recruited from endocrinology and Gynecology clinics through a collaborative research initiative between the Department of Obstetrics & Gynaecology at BHU and Chandan Hospital. The study sample was divided into two groups: a Group I (I) comprising 200 women fulfilling the Rotterdam criteria for PCOS diagnosis, and a Group II(II) 300 consisting of 341 age-matched women without PCOS. The study was initiated in July 2023, concluded in February 2024, and received ethical approval from the Institutional Ethics Board (BHU/HIMS/IRB/2020-2021/79) on March 8, 2021.

2.2. Data collection

A comprehensive data collection approach was employed for this study.

2.3. Medical records

Participants' existing medical records were meticulously reviewed to extract pertinent medical history and clinical information.

2.4. Laboratory assessments

Blood samples were obtained from all participants and analyzed using standardized protocols on automated laboratory equipment.

2.5. Structured interviews

In-depth structured interviews were conducted to gather detailed information on:

1. Reproductive history: To understand menstrual patterns and reproductive experiences.
2. Ovarian ultrasound findings: To confirm PCOS diagnosis in the Group I using ultrasound machines that met diagnostic criteria.
3. Fertility treatments: To assess previous exposure to fertility interventions.

2.6. Anthropometric measurements

BMI and waist circumference were measured using calibrated scales and stadiometers.

2.7. Cardiovascular evaluation

Blood pressure measurements were obtained using validated sphygmomanometers. Additionally, electrocardiograms (ECGs) and echocardiograms were performed on selected participants using appropriate diagnostic equipment.

2.8. Arithmetical (Data) analysis

All collected comprehensive data was analyzed using SPSS-20.0 and descriptive statistics provided a summary of the data for each group (I & II). Chi-square tests were used to compare categorical variables, such as the presence or absence of PCOS, between the groups. T-tests were employed to compare continuous variables, including blood pressure readings, between the groups. Multivariate logistic regression was conducted to assess the potential association between PCOS and various health risks, while accounting for factors that might influence the results, such as age. A statistically significant association was established at a p-value of less than 0.05. This multi-faceted approach to data collection and analysis aimed to provide

a comprehensive understanding of the long-term health consequences associated with PCOS.

3. Result

The study consisted of 500 women, categorized into two groups: 200 women with PCOS and 300 controls having the same age. Comparative data-analysis of health risks and complications between the groups (I & II) revealed significant disparities. As outlined in Table 1, demographic data indicated a notably higher BMI and waist circumference among women with PCOS compared to the Group II, suggesting a greater incidence of obesity and central adiposity within the PCOS cohort. However, the mean age of participants was comparable across both groups.

The prevalence of IR, T2DM, hypertension, dyslipidemia, elevated CRP levels, anovulation, and also infertility was significantly higher in PCOS women when compared to Group II (Control), as detailed in Table 2.

Table 3 presented a significantly higher prevalence of IR in Group I (72%) when compared with Group II (25%)($p<0.001$). Furthermore, PCOS women exhibited an increased risk of developing T2DM, with an odds ratio of 4.2(95% CI: 3.1-5.6).

PCOS women exhibited significantly higher rates of hypertension, dyslipidemia, and elevated CRP levels compared to Group II. These findings underscore an increased risk of CVD) in PCOS women, as evidenced by the notably higher OR for these conditions presented in Table 4.

Table 5 demonstrates that anovulation affected 80% of women with PCOS, resulting in significantly higher infertility rates within this group (50%) compared to Group II (10%) ($p<0.001$). The substantially increased likelihood of infertility among women with PCOS often necessitated additional fertility interventions, such as ovulation induction and assisted reproductive technologies (ART).

4. Discussion

This study expands our understanding of PCOS as a multifaceted health condition extending beyond reproductive challenges.[1] The significantly increased prevalence of metabolic and cardiovascular risks in PCOS women underscores the imperative for comprehensive management strategies that transcend fertility concerns.[1]

4.1. Metabolic dysfunction and long-term health

The robust association between PCOS and insulin resistance (IR), coupled with the heightened risk of T2DM, emphasizes the need for early interventions targeting insulin sensitivity and glycemic control.[2] While recent meta-analyses studies have explained the efficacy of low-glycaemic index diets in managing PCOS symptoms and improving metabolic health,[3,4] further research is essential to evaluate the effectiveness of personalized carbohydrate management strategies tailored to individual needs and preferences.[5] Additionally, investigating the impact of medications like metformin and newer agents, such as glucagon-like peptide-1(GLP-1) receptor agonists, on PCOS management warrants exploration.[6] To optimize long-term adherence to lifestyle changes, research on the benefits of nutritional counseling and support groups for women with PCOS is warranted.[7]

4.2. Cardiovascular disease risk and preventive strategies

The observed association between PCOS and heightened cardiovascular disease (CVD) risk necessitates in-depth research. Investigating the underlying mechanisms, including chronic inflammation and abnormal lipid profiles, could inform the development of targeted preventive measures.[8] Studies evaluating the efficacy of lifestyle modifications, such as Mediterranean diets and cardiovascular-focused exercise programs, in reducing CVD risk among women with PCOS are warranted.[9,10] Furthermore, examining the potential benefits of early cholesterol-lowering medications and identifying specific CVD risk factors could aid in mitigating long-term complications.[11]

4.3. Fertility and individualized care

While this study reinforces the well-established link between PCOS and anovulation, additional research is required to identify optimal treatments for individual fertility needs. Comparative evaluations of success rates and potential side effects among various ovulation-induction medications, including clomiphene citrate and letrozole, as well as tailored assisted reproductive technologies (ART) for different PCOS phenotypes, could provide valuable clinical guidance.[12] Moreover, exploring the psychosocial impact of PCOS-related infertility and the benefits of support groups or psychological counseling can contribute to a more comprehensive approach to fertility management.[13]

4.4. Addressing knowledge gaps and personalization

The cross-sectional design of this study underscores the need for longitudinal research to establish causal relationships and identify early predictors of health complications in PCOS women. Moreover, investigating variations in PCOS-prevalence, presentation, and associated health risks across different populations is crucial for developing culturally sensitive and personalized healthcare strategies.[14,15] Given the potential regional variations in PCOS prevalence, as suggested by Bharali et al. further

Table 1: Presenting demographic evaluation of both groups

Demographic Parameter	Group I (n = 200)	Group II (n = 300)	p-value
Age(years)	28.5 ± 5.30	29.2 ± 5.10	0.152
BMI(kg/m^2)	30.1 ± 6.4	24.8 ± 5.2	<0.001
Waist Circumference (cm)	90.3 ± 12.5	78.4 ± 10.2	<0.001

Table 2: Health risks and complications in women with PCOS compared with controls

Health-Parameter	Group I (n = 200)	Group II (n = 300)	p-value	OR	95% at CI
Insulin Resistance	72%	25%	<0.001	7.8	6.1-9.9
Type 2 Diabetes Mellitus	35%	10%	<0.001	4.2	3.1-5.6
Hypertension	45%	20%	<0.001	3.2	2.5-4.1
Dyslipidemia	60%	30%	<0.001	3.5	2.8-4.4
Elevated CRP	50%	20%	<0.001	3.8	2.9-4.9
Anovulation	80%	10%	<0.001	24.0	15.8-36.4
Infertility	50%	10%	<0.001	9.0	6.4-12.7

Note- Odds Ratio-OR.; 95% Confidence Interval-CI

Table 3: Shows comparative data of T2DM and IR between PCOS and their control

Biochemical-Parameter	Group I (n=200)	Group II (n=300)	p-value	OR	95% CI
Insulin Resistance	72%	25%	<0.001	7.8	6.1-9.9
Type 2 Diabetes Mellitus	35%	10%	<0.001	4.2	3.1-5.6

Table 4: Incidence rate of CVD in both groups of study (PCOS and their control)

Cardio-Parameter	Group I (n=200)	Group II (n=300)	p-value	OR	95% CI
Hypertension	45%	20%	<0.001	3.2	2.5-4.1
Dyslipidemia	60%	30%	<0.001	3.5	2.8-4.4
Elevated CRP	50%	20%	<0.001	3.8	2.9-4.9

Table 5: Representing the fertility issues of the both groups

Parameter	Group I (n=200)	Group II (n=300)	p-value	OR	95% C CI
Anovulation	80%	10%	<0.001	24.0	15.8-36.4
Infertility	50%	10%	<0.001	9.0	6.4-12.7

research focusing on underrepresented populations is essential.[16]

4.5. Management strategies

A multidisciplinary approach is essential for effective PCOS management key strategies include:

1. Lifestyle interventions: Emphasizing diet and exercise to enhance insulin sensitivity and reduce cardiovascular risk.[17,18]
2. Pharmacotherapy: Utilizing metformin for insulin resistance management, oral contraceptives for menstrual cycle regulation, and anti-androgens for hyperandrogenism.[19]
3. Regular monitoring: Implementing routine screenings for diabetes, cardiovascular health, and endometrial hyperplasia to facilitate early detection and management of complications.[20]

5. Conclusion

In conclusion, this study reinforces the significant enduring health risks associated with PCOS, including metabolic, cardiovascular, and reproductive complications. These findigs highlight the importance of comprehensive management strategies to address the multifaceted nature of PCOS and improve health outcomes for affected women. Early screening, lifestyle interventions, and targeted treatments are essential components of effective PCOS management.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Teede HJ, Misso ML, Costello MF, Dokras A, Laven J, Moran L, et al. Recommendations from the international evidence-based guideline for the assessment and management of polycystic ovary syndrome. *Hum Reprod*. 2018;33(9):1602–18.
2. Palomba S, Wilde MAD, Falbo A, Koster MPH, Sala GBL, Fauser B. Pregnancy complications in women with polycystic ovary syndrome. *Hum Reprod Update*. 2015;21(5):575–92.
3. Azziz R, Carmina E, Chen ZJ, Dunaif A, Laven JSE, Legro RS, et al. Polycystic ovary syndrome. *Nat Rev Dis Primers*. 2016;2(1):16057.
4. Bozdag G, Mumusoglu S, Zengin D, Karabulut E, Yildiz BO. The prevalence and phenotypic features of polycystic ovary syndrome: a systematic review and meta-analysis. *Hum Reprod*. 2016;31(12):2841–55.
5. Moghetti P, Tosi F. Insulin resistance and polycystic ovary syndrome. *Curr Opin Endocr Metab Res*. 2021;18:18–27.
6. Purwar A, Nagpure S. Cardiovascular Risk in Women With PCOS. *Int J Endocrinol Metab*. 2012;10(4):611–8.
7. Rippe JM. Lifestyle Strategies for Risk Factor Reduction, Prevention, and Treatment of Cardiovascular Disease. *Am J Lifestyle Med*. 2018;13(2):204–12.
8. Cowan S, Lim S, Alycia C, Pirotta S, Thomson R, Gibson-Helm M, et al. Lifestyle management in polycystic ovary syndrome – beyond diet and physical activity. *BMC Endocr Disord*. 2023;23(2):14.
9. Skiba MA, Islam RM, Bell RJ, Davis SR. Understanding variation in prevalence estimates of polycystic ovary syndrome: a systematic review and meta-analysis. *Hum Reprod Update*. 2018;24(6):694–709.
10. Escobar-Morreale HF. Polycystic ovary syndrome: definition, aetiology, diagnosis and treatment. *Nat Rev Endocrinol*. 2018;14(5):270–84.
11. Yildiz BO, Bozdag G, Yapici Z, Esinler I, Yarali H. Prevalence, phenotype and cardiometabolic risk of polycystic ovary syndrome under different diagnostic criteria. *Hum Reprod*. 2012;27(10):3067–73.
12. Stein IF, Leventhal ML. Amenorrhea associated with bilateral polycystic ovaries. *Am J Obstet Gynecol*. 1935;29(2):181–91.
13. Kar S. Anthropometric, clinical, and metabolic comparisons of the four Rotterdam PCOS phenotypes: a prospective study of PCOS women. *J Hum Reprod Sci*. 2013;6(3):194–200.
14. Lizneva D, Suturina L, Walker W, Brakta S, Gavrilova-Jordan L, Azziz R. Criteria, prevalence, and phenotypes of polycystic ovary syndrome. *Fertil Steril*. 2016;106(1):6–15.
15. Luque-Ramírez M, Escobar-Morreale HF. Polycystic ovary syndrome as a paradigm for prehypertension, prediabetes, and preobesity. *Curr Hypertens Rep*. 2014;16(12):500.
16. Bharali MD, Rajendran R, Goswami J, Singal K, Rajendran V. Prevalence of Polycystic Ovarian Syndrome in India: A Systematic Review and Meta-Analysis. *Cureus*. 2020;14(12):e32351.
17. Rotterdam ESHRE/ASRM-Sponsored PCOS consensus workshop group. Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome (PCOS). *Hum Reprod*. 2004;19(1):41–7.
18. Barber TM, Hanson P, Weickert MO, Franks S. Obesity and polycystic ovary syndrome: implications for pathogenesis and novel management strategies. *Clin Med Insights Reprod Health*. 2019;13:1179558119874042.
19. Melin J, Forslund M, Alesi S, Piltonen T, Romualdi D, Spritzer PM, et al. Metformin and Combined Oral Contraceptive Pills in the Management of Polycystic Ovary Syndrome: A Systematic Review and Meta-analysis. *J Clin Endocrinol Metab*. 2023;109(2):817–36.
20. Melo AS, Ferriani RA, Navarro PA. Treatment of infertility in women with polycystic ovary syndrome: approach to clinical practice. *Clinics (Sao Paulo)*. 2015;70(11):765–9.

Author's biography

Alka Rai, Assistant Professor

Akanksha Gupta, Senior Consultant

Sanjeev Kumar Yadav, Associate Professor

Rinki Kumari, Scientific Officer https://orcid.org/0000-0003-4720-795X

Cite this article: Rai A, Gupta A, Yadav SK, Kumari R. Long-term implications of polycystic ovary syndrome (PCOS): An in-depth study on associated health risks and complications. *Indian J Obstet Gynecol Res* 2025;12(1):74-78.