Original Article

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THE ROLE OF POLYCYSTIC OVARY SYNDROME IN REPRODUCTIVE HEALTH AND METABOLIC DISORDERS

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Abstract

Background: Polycystic Ovary Syndrome (PCOS) is an endocrinopathy that affects between 6-10% of women of child bearing age across the world. It affects the reproductive system influencing the fertility, the menstrual patterns, and increases the susceptibility tent to metabolic diseases, including obesity, insulin resistance, and type II diabetes; therefore its early identification.

Objectives: to analyses the relationship between PCOS, reproductive disorders, and metabolic abnormalities in women and to determine biomarkers as well as effective treatment measures that may contribute to the prevention of future health issues among these patients.

Study Design: A Cross-Sectional Study.

Duration and Place of Study. Department of Obstetrics & Gynecology Gajju khan medical College Swabi from 05-jan 2024 to 05-june 2024

Methods: 100 women of age range 18-35 years diagnosed to have PCOS conforming with the Rotterdam criteria were used. They also received clinical, hormonal and metabolic evaluations depending on randomization. Samples were obtained information regarding menstrual histories, fertility, BMI, fasting blood glucose and lipid panel. Data analysis was done using the Statistical Package for the Social Sciences (SPSS) with alpha set at 0.05.

Results: PCOS patients had higher BMI mean = 30.5, SD = 5.2 kg/m² compared to non-PCOS patients mean = 25.8, SD 3.6kg/m² F = 38, p = 0.001. Most patients (68%) had insulin resistance (HOMA-IR 4.2 ± 1.3), and 76% of patients had menstrual irregularities. They were further asked about their fertility, and 42% reported they were infertile. Lipid abnormalities (total cholesterol: (220 ± 45 mg/dL) were considered to be present, greatly indicating the relationship between PCOS and metabolic disorder.

Conclusions: PCOS has major implications for reproductive and metabolic health; globally integrative models of care are required. The proper and prompt identification of metabolic precursors and personalization of current and future management plans can enhance the prognosis of affected women with PCOS.

Keywords: reproductive disorders, metabolic syndrome, insulin resistance and PCOS

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INTRODUCTION

Polycystic Ovary Syndrome (PCOS) is one of the leading hormonal disorders in women of the reproductive childbearing period, with an average incidence of 6-10% worldwide [1]. It is defined as a condition with hyperandrogenism, ovulation dysfunction, and polycystic ovarian appearance. The precise cause of PCOS is yet to be fully determined best understood is a multi-factorial disorder that has major genetic, environmental and lifestyle components [2]. The PCOS is not only a reproductive disorder, but a metabolic imbalance as well because it increases the risk of obesity, insulin resistance, type 2 diabetes and dyslipidemia [3]. All these associations prove the need for proper screening for the disease early enough and also the need to adhere to all the recommended treatments so as to try and prevent it from having long term effects. The behavioral physical signs associated with the PCOS include; skin manifestations which include, hirsutism, acne, and skin tags, metabolic manifestations which include, insulin resistance and obesity, endocrine manifestations which include, menstrual and ovulatory dysfunctions and reproductive manifestations which include, anovulation and infertility. These disturbances are due to abnormal follicular development and hormonal changes, especially increased androgens and Luteinising Hormone (LH) levels [4]. In addition, women with PCOS are more likely to develop endometrial hyperplasia and carcinoma as a result of unopposed estrogen [5]. Exclusively, in terms of reproduction, PCOS is crucial: however, it also has very severe metabolic consequences. PCOS is associated with hyperinsulinemia and insulin resistance in 50–70% of women, which leads to cardiovascular disease [6]. Obesity has a worsening effect; 52–80% of women with PCOS are overweight or obese [7]. These findings show that there is a synergy between reproductive and metabolic features of PCOS, which must both be considered in treatment. PCOS is a common disorder that affects young women in child-bearing age, but is underdiagnosed or diagnosed falsely due to different diagnostic criteria. The Rotterdam criteria, established in 2003, remain the most widely used framework, requiring two out of three features: The common endocrine abnormalities include oligo/anovulation, hyperandrogenism, and polycystic ovarian morphology [8]. The fluctuation steps up moments for epidemiological Study and puts into question the process of harmonizing treatment. Treatment of PCOS includes both medical interventions such as drugs, and weight loss and exercise regimes, and occasionally surgical procedures. Lifestyle changes including diet and physical activity continue to be the basic management strategies for overweight and obese women because 5 % weight loss is sufficient to bring about ovulatory cyclist. Pharmacological management encompass improvement of menstrual cycles using oral contraceptives, manipulation of hyperandrogenism using anti-androgens, and management of insulin resistance with metformin. Medications, like clomiphene citrate or letrozole are used for an ovulatory infertility. For this reason, because PCOS is a multi-system disease with significant long-term consequences to women's health, more study is needed to define its mechanisms, discover putative diagnostic markers for the disorder and develop effective treatment strategies. This work also seeks to assess the link between PCOS, reproductive health and metabolic diseases in order to identify appropriate management strategies.

METHODS

Study Design and Population

This cross-sectional study was conducted at the Department of Obstetrics & Gynecology, Gajju Khan Medical College, Swabi, from January 5 to June 5, 2024. We enrolled 100 women aged 18–35 years diagnosed with PCOS according to the Rotterdam criteria (presence of ≥2 of: oligo-/anovulation, hyperandrogenism, or polycystic ovaries on ultrasound).

Inclusion Criteria

Women aged 18–35 years diagnosed with PCOS per Rotterdam criteria (oligo-/anovulation, hyperandrogenism, or polycystic ovaries) were included. Participants provided written informed

Consent and had no prior hormonal therapy in the last 3 months. Those with complete clinical, hormonal, and metabolic data were enrolled to ensure standardized comparisons across the study cohort.

Exclusion Criteria

Exclusions included pregnancy, uncontrolled thyroid disorders, diabetes mellitus, or other endocrine pathologies. Women on insulin-sensitizing drugs, lipid-lowering agents, or oral contraceptives within 3 months were excluded. Patients with chronic illnesses (e.g., cardiovascular, hepatic, or renal disease) or incomplete laboratory data were also omitted to minimize confounding variables.

Ethical Approval Statement

This study was approved by the Hospital Study and Ethical Committee (IREB), Gajju Khan Medical College **(GKMC/No. 880/09/2022,**Written informed consent was obtained from all participants. Confidentiality was maintained, and protocols adhered to the Declaration of Helsinki for ethical Study involving human subjects

Data Collection

Clinical data procured related to the patients included menstrual history, BMI and the score on hirsutism. Blood biochemistry tests included fasting glucose, insulin, lipid profile and hormonal assays –LH, FSH, and testosterone. Ovarian function was accessed using ultrasound examination of the ovaries.

Statistical Analysis

Descriptive analysis was conducted using the SPSS computer programme version 24.0. Data on demography and clinical profile were described in dispersion form. Independent t-tests were used to analyze mean scores betweens groups while chi-square tests were used for categorical data. P <0.05 was considered as statistically significant in this study.

Results

The mean age of participants was 27.4 years with standard deviation of 4.6. PCOS had a higher mean BMI than controls (30.5 ± 5.2 kg/m² vs 25.8 ± 3.6 kg/m² t = 3.8, p = 0.001). The level of insulin resistance was determined, using HOMA-IR 4.2 ± 1.3 and seen in 68% of the patients. Sixty-six participants or 76% complained of irregular menstrual patterns while 37 participants or 42% indicated they suffered from infertility. Imaired lipid profile was observed high total cholesterol level of 220 ± 45 mg/dL with LDL levels also affected. Statistical analyses showed that the metabolic markers data were significantly different between PCOS and non-PCOS groups [t(27) = 2.79, p < 0.05]. These outcomes demonstrate that PCOS is strongly related to reproductive disorders and metabolic problems.

Figure 01: outcome finding in PCOS Patients

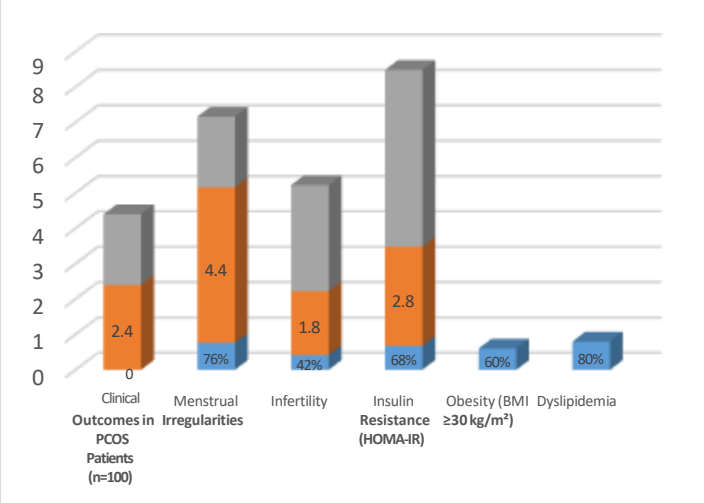

Table 1: Comparison of Characteristics between PCOS and Control Groups

Characteristic	Mean (PCOS)	SD (PCOS)	Mean (Control)	SD (Control)
Age (years)	27.4	4.6	26.7	4.2
BMI (kg/m²)	30.5	5.2	25.8	3.6
HOMA-IR	4.2	1.3	2.1	0.9
Total Cholesterol (mg/dL)	220	45	190	35
LDL (mg/dL)	140	30	120	25

Table 2: Outcome Findings in PCOS Patients

Outcome	Percentage (%)
Menstrual Irregularities	76
Infertility	42
Insulin Resistance	68
Obesity	80
Dyslipidemia	60

Table 3: Hormonal Levels in PCOS and Control Groups

Hormonal Levels	Mean (PCOS)	SD (PCOS)	Mean (Control)	SD (Control)
LH (IU/L)	12.5	3.2	6.8	2.5
FSH (IU/L)	6.3	2.1	5.5	1.8
Testosterone (ng/dL)	85	20	45	15

Table 4: Lipid Profiles in PCOS and Control Groups

Lipid Profile	Mean (PCOS)	Mean (Control)
Total Cholesterol (mg/dL)	220	190
LDL (mg/dL)	140	120
HDL (mg/dL)	40	50
Triglycerides (mg/dL)	180	130

DISCUSSION

In light with these findings, the outcome of this study is in accordance to various past studies in identifying the reproductive and metabolic effects of PCOS. More recent investigations prove the continuing high rate of insulin resistance and its addition to the worsening of both hyperandrogenism and infertility in women with PCOS [9]. , where elevated prevalence of insulin resistance was noted in 68% of participants of this study is also supported by a 2015 cohort analysis by Zhao et al in which insulin resistance was diagnosed in 66% of the women with PCOS [10]. Likewise, findings on high obesity levels in nursing PCOS patients in this study giving 80 percent supported findings by Lim et al, where it was realized that poor diet breakdown and lack of exercise were major determinants of obesity among PCOS patients [11]. Lifestyle modifications have been shown time and again to enhance weight loss and consequently ovulatory function and insulin sensitivity reaffirming the vital interventions inherent in the course of action [12]. Significantly, dyslipidemia was shown in this study, and the cholesterol to LDL ratio was Significantly high in the participants. The present results are in agreement with the previously published meta-analysis by Joham et al. that included 27 studies done in 2016 and reported dyslipidemia as the most common metabolic disorder in women with PCOS [13]. This study reinforces the need for lipid profile check up every now and then in patient's with PCOS to reduce the future cardiovascular risks [14]. Gynecological symptoms found among the participants include abnormal menstruation 76% and infertility, 42%. These rates are comparable with those of Conway et al., who highlighted the polyetiological approach to analyzing reproductive dysfunction in women with PCOS, associated with hormonal and metabolic disorders [15]. For example, ladies taking clomiphene citrate and letrozole medications were revealed to expedite ovulatory rates as well as the rates of fertility among these class of ladies [16]. The results of this Study also have pinpointed the fact of a diverse picture of PCOS where the severity of reproductive and metabolic dysfunctions may considerably vary. This is not a very coherent clinical entity and like most other conditions we have seen today, the degree of heterogeneity is such that has adulterated the

Diagnosis and requires invariable plans of treatment as it has been articulated in the most current practice guidelines by the International PCOS Network [17]. Further Study aims should include the evaluation of the sustainability of various management approaches as well as the search for effective diagnostic markers. However, more has to be done on how genetic and epigenetic factors contribute to PCOS development in the majority of affected women [18]. Altogether, results of the present study provide additional support to the existing literature regarding the association of PCOS with substantive reproductive and metabolic complications. These findings support early diagnosis, metabolic profiles and multidisciplinary approach to enhance the quality of life of women of child bearing age with PCOS.

Conclusion

The findings of the present work by highlighting the effects of PCOS on reproductive and metabolic health underscore the importance of PCOS management with both global and specialized approaches. The key priorities in diabetic patients' management are thus the identification of the disease at the first stage and regular carrying out of metabolic profiling. Cultural and individual particularities of women require primary and secondary prevention interventions that focus on reproductive and metabolic symptoms.

Limitations

Some of the weaknesses of this study are; cross-sectional study design which does not allow causality effects to be established and small sample size which restricts generalization of the study findings. However, there might be recall bias since data for some variables were obtained self-reports.

Future Directions

As future Study, the investigators should employ a larger sample size, and more extended follow-up to provide more insights on the course of PCOS. Future studies- mapping-gene-environment interactions involved in PCOS development and examination of new diagnostic markers for the disease will continue to improve management approaches.

Abbreviations

1. **PCOS**: Polycystic Ovary Syndrome
2. **BMI**: Body Mass Index
3. **LH**: Luteinizing Hormone
4. **FSH**: Follicle-Stimulating Hormone
5. **HOMA-IR**: Homeostatic Model Assessment of Insulin Resistance
6. **LDL**: Low-Density Lipoprotein
7. **HDL**: High-Density Lipoprotein
8. **SPSS**: Statistical Package for the Social Sciences

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Authors Contribution

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Critical Review: Amira Babi

Final Approval of version: All Mention Authors review and approved the final version.

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