

## From PCOS to PMOS: Understanding the Metabolic and Endocrine Dimensions of a Complex Disorder

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### Abstract-

*Polycystic Ovary Syndrome (PCOS), increasingly conceptualized by some researchers as a predominantly metabolic ovarian syndrome (PMOS), is one of the most common endocrine disorders affecting women of reproductive age. The disorder is characterized by hyperandrogenism, ovulatory dysfunction, insulin resistance, and polycystic ovarian morphology. Over recent decades, scientific understanding of the syndrome has evolved from a purely gynecological disorder to a multisystem metabolic disease with endocrine, cardiovascular, reproductive, and psychological implications. The transition in terminology from PCOS to PMOS reflects growing emphasis on the metabolic origins and systemic consequences of the disorder. The global prevalence of PCOS ranges from 6–20% depending on diagnostic criteria, with Indian studies reporting prevalence rates between 8% and 22%. Insulin resistance and hyperinsulinemia are now recognized as central pathogenic mechanisms contributing to ovarian dysfunction and metabolic complications.*

*This paper examines the epidemiology, etiology, pathophysiology, clinical manifestations, diagnostic criteria, and treatment modalities associated with PCOS/PMOS. It further explores recent advances involving artificial intelligence, genetic markers, gut microbiome research, and emerging pharmacological therapies. Evidence-based approaches to lifestyle modification, medical management, and public health prevention strategies are critically analyzed. Understanding the metabolic and endocrine dimensions of this disorder is essential for early diagnosis, individualized therapy, and long-term prevention of complications such as type 2 diabetes mellitus, infertility, cardiovascular disease, and endometrial carcinoma.*

**Keywords:** PCOS, PMOS, insulin resistance, hyperandrogenism, metabolic syndrome, reproductive endocrinology, ovarian dysfunction

### Introduction

Polycystic Ovary Syndrome (PCOS) is a heterogeneous endocrine and metabolic disorder affecting women during reproductive years. Traditionally, the condition was defined primarily by ovarian dysfunction and polycystic ovarian morphology. However, emerging

evidence has highlighted the significant metabolic abnormalities underlying the syndrome, leading some researchers to advocate the term “Polymetabolic Ovarian Syndrome” (PMOS) to better reflect its systemic metabolic nature.

PCOS is characterized by chronic anovulation, hyperandrogenism, insulin resistance, and multiple cystic follicles in the ovaries. According to the Rotterdam criteria established in 2003, diagnosis requires the presence of at least two of the following three features: oligo/anovulation, clinical or biochemical hyperandrogenism, and polycystic ovaries on ultrasonography.

Globally, PCOS affects millions of women, making it one of the most prevalent endocrine disorders worldwide. Prevalence varies according to diagnostic criteria and population demographics. Studies in India report prevalence rates ranging from 8% to 22%, especially among urban adolescents and young adults. Sedentary lifestyles, obesity, dietary transitions, and genetic predisposition contribute significantly to increasing incidence rates.

Clinically, PCOS has major reproductive, metabolic, dermatological, and psychological implications. Women with the disorder are at increased risk of infertility, obesity, type 2 diabetes mellitus, dyslipidemia, hypertension, obstructive sleep apnea, anxiety, depression, and cardiovascular disease.

### **Etiology and Risk Factors**

The etiology of PCOS/PMOS is multifactorial and involves genetic, hormonal, metabolic, and environmental interactions.

#### **Genetic Factors:**

Family clustering and twin studies suggest strong genetic predisposition. First-degree relatives of affected women exhibit higher risk of developing PCOS and metabolic syndrome.

#### **Environmental Factors:**

Environmental endocrine disruptors such as bisphenol-A (BPA), phthalates, and industrial chemicals may interfere with ovarian steroidogenesis and insulin sensitivity.

#### **Lifestyle Factors:**

Obesity is strongly associated with PCOS, particularly central adiposity. Excess adipose tissue worsens insulin resistance and hyperandrogenism through inflammatory cytokines and adipokines.

#### **Hormonal and Metabolic Contributors:**

Hyperinsulinemia plays a central role in disease development. Elevated insulin levels stimulate ovarian theca cells to produce excess androgens. Simultaneously, insulin suppresses

hepatic production of sex hormone-binding globulin (SHBG), increasing free testosterone levels.

## Pathophysiology

The pathophysiology of PCOS/PMOS involves complex interactions between the hypothalamic-pituitary-ovarian axis, insulin signaling pathways, adipose tissue metabolism, and inflammatory mediators.

A hallmark feature is insulin resistance, present even in many non-obese patients. Insulin resistance results in compensatory hyperinsulinemia, which enhances ovarian androgen synthesis.

The primary hormonal abnormalities include increased luteinizing hormone (LH), altered follicle-stimulating hormone (FSH), and elevated androgen levels. This altered LH:FSH ratio impairs follicular maturation, resulting in arrested follicular development and chronic anovulation.

Inflammatory cytokines such as TNF- $\alpha$  and IL-6 contribute to endothelial dysfunction and metabolic complications. Emerging research also suggests gut microbiota alterations may influence insulin sensitivity and systemic inflammation.

## Clinical Features

Clinical manifestations vary widely depending on phenotype and severity.

Menstrual abnormalities include oligomenorrhea, amenorrhea, and irregular cycles. Hyperandrogenic features include hirsutism, acne vulgaris, androgenic alopecia, and seborrhea.

Metabolic manifestations include obesity, central adiposity, insulin resistance, and acanthosis nigricans.

Long-term complications include type 2 diabetes mellitus, dyslipidemia, hypertension, endometrial carcinoma, infertility, and cardiovascular disease.

Psychological manifestations such as anxiety, depression, and body image disturbances are also common.

## Diagnosis and Investigations

Diagnosis is based primarily on Rotterdam criteria requiring at least two of the following:

1. Oligo/anovulation
2. Hyperandrogenism
3. Polycystic ovarian morphology

Laboratory investigations include hormonal assays such as testosterone, DHEAS, LH/FSH ratio, prolactin, and thyroid profile.

Metabolic assessment includes fasting blood glucose, HbA1c, lipid profile, and oral glucose tolerance test.

Ultrasonography demonstrates enlarged ovaries with multiple small peripheral follicles.

Differential diagnosis includes congenital adrenal hyperplasia, Cushing syndrome, hyperprolactinemia, thyroid disorders, and androgen-secreting tumors.

### **Management and Treatment**

Management is individualized according to symptoms, fertility goals, and metabolic risk profile.

Lifestyle modification remains first-line therapy. Dietary interventions include low glycemic index diets, calorie restriction, increased fiber intake, and avoidance of processed foods.

Exercise programs involving aerobic and resistance training improve insulin sensitivity and promote weight reduction.

Medical therapy includes metformin, combined oral contraceptive pills, spironolactone, letrozole, and clomiphene citrate.

Newer therapeutic agents include GLP-1 receptor agonists and inositol supplements.

Surgical management such as laparoscopic ovarian drilling may be used in clomiphene-resistant infertility cases.

### **Prevention and Public Health Importance**

Preventive approaches focus on healthy diet, physical activity, weight control, and early screening.

Women with PCOS should undergo regular monitoring for diabetes mellitus, dyslipidemia, hypertension, and mental health disorders.

Awareness programs in schools and colleges can improve early diagnosis, lifestyle compliance, and psychological support.

The increasing burden of obesity and sedentary lifestyles has made PCOS a major public health challenge globally.

### **Recent Advances and Current Research**

Recent research has transformed understanding of PCOS/PMOS.

Artificial intelligence and machine learning algorithms are being developed to predict PCOS risk and personalize treatment.

Genetic and epigenetic studies are exploring DNA methylation, microRNA biomarkers, and gene-environment interactions.

Gut microbiome research suggests altered gut flora may contribute to insulin resistance and chronic inflammation.

Emerging pharmacological agents such as semaglutide and liraglutide show promising results in improving metabolic and reproductive outcomes.

## Discussion

PCOS/PMOS represents a complex interaction between reproductive endocrinology and metabolic dysfunction. The evolving terminology from PCOS to PMOS reflects the growing recognition that metabolic abnormalities are central rather than secondary features.

Current evidence strongly supports insulin resistance as a primary pathogenic mechanism. However, heterogeneity in clinical presentation complicates diagnosis and treatment standardization.

Lifestyle modification remains the cornerstone of management, yet long-term adherence remains challenging. Emerging research involving genetics, microbiome science, and artificial intelligence may facilitate personalized medicine approaches in the future.

## Conclusion

PCOS, increasingly conceptualized as PMOS, is a multifaceted endocrine-metabolic disorder with significant reproductive and systemic consequences. Insulin resistance, hyperandrogenism, and chronic inflammation form the cornerstone of disease pathogenesis.

Early diagnosis and comprehensive management are essential to reduce long-term complications. Lifestyle intervention remains the most effective foundational therapy, while newer pharmacological and technological advances offer promising future directions.

Continued research into genetics, biomarkers, gut microbiota, and precision medicine may further improve individualized treatment strategies and overall patient outcomes.

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