MODERN DIAGNOSTIC AND THERAPEUTIC APPROACHES TO POLYCYSTIC OVARY SYNDROME (PCOS)

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Abstract: Polycystic Ovary Syndrome (PCOS) is one of the most common endocrine and metabolic disorders in women of reproductive age, with a global prevalence ranging from 10% to 25%, depending on diagnostic criteria. The syndrome is characterized by oligo- or anovulation, hyperandrogenism, and polycystic ovarian morphology. In recent years, new insights into its pathogenesis have emphasized the importance of insulin resistance, chronic low-grade inflammation, and neuroendocrine dysregulation. PCOS not only affects reproductive health but also increases the risk of type 2 diabetes mellitus, cardiovascular diseases, and psychological disorders. This paper highlights modern diagnostic strategies and therapeutic approaches to PCOS in light of the latest international guidelines and research published between 2023 and 2025.

Keywords: Polycystic Ovary Syndrome, Insulin Resistance, Diagnosis, Metformin, Reproductive Health, Endocrine Disorders

Introduction

Polycystic Ovary Syndrome (PCOS) represents a complex, multifactorial endocrine disorder involving hormonal, metabolic, and reproductive dysfunctions. According to the 2023 International Evidence-Based PCOS Guidelines, developed by ESHRE, ASRM, and the Endocrine Society, approximately one in five women of reproductive age may be affected worldwide. The etiology of PCOS remains unclear, but genetic predisposition, insulin resistance, environmental factors, and lifestyle are considered significant contributors.

Recent epidemiological data indicate that the prevalence of PCOS is increasing, particularly among younger women, largely due to rising rates of obesity and metabolic syndrome. Moreover, PCOS has a profound psychosocial impact, as it is often associated with anxiety, depression, and decreased quality of life. Therefore, modern approaches to PCOS diagnosis and therapy must integrate metabolic, reproductive, and psychological aspects.

Modern Diagnostic Approaches

Diagnosis of PCOS remains challenging due to its heterogeneous clinical manifestations. The Rotterdam Criteria (2003, revised 2023) continue to be the most widely accepted diagnostic framework. According to these criteria, PCOS is diagnosed when two of the following three features are present: (1) Oligo- or anovulation; (2) Clinical and/or biochemical signs of hyperandrogenism; (3) Polycystic ovarian morphology on ultrasound.

The AE-PCOS Society and NIH criteria emphasize the importance of hyperandrogenism as a central diagnostic feature, which ensures more specific identification of the syndrome.

Laboratory testing should include measurement of luteinizing hormone (LH), follicle-stimulating hormone (FSH), total and free testosterone, DHEA-S, prolactin, thyroid-stimulating hormone (TSH), fasting insulin, and glucose. The HOMA-IR index (Homeostasis Model Assessment of Insulin Resistance) is widely used to assess insulin sensitivity. In 2024 studies, HOMA-IR values above 2.5 were associated with a threefold increase in the risk of metabolic complications among women with PCOS (Franks et al., 2024).

Transvaginal ultrasonography remains the gold standard for evaluating ovarian morphology. However, recent recommendations (ESHRE 2024) suggest incorporating 3D ultrasound and ovarian stromal vascularity assessment to improve diagnostic accuracy. MRI imaging can also be used in complex cases, particularly for differential diagnosis of androgen-secreting tumors.

Advances in genetic research have identified associations between PCOS and several candidate genes, including CYP17A1, INSR, DENND1A, and FSHR. Epigenetic modifications related to obesity and stress exposure further contribute to PCOS development. These findings may pave the way for future personalized diagnostics and precision medicine approaches in PCOS management.

Therapeutic Strategies

Modern treatment of PCOS is multidisciplinary, targeting reproductive, metabolic, and psychological components of the disorder. The 2023 International PCOS Guideline underscores lifestyle modification as the foundation of therapy, supported by pharmacological interventions when necessary.

Weight management through dietary changes and physical activity remains the first-line approach. Even a 5–10% reduction in body weight can significantly improve insulin sensitivity, menstrual regularity, and ovulatory function. Recent meta-analyses (Teede et al., 2024) demonstrate that combining aerobic exercise with resistance training yields superior outcomes compared to either alone. Psychological counseling and cognitive-behavioral therapy are recommended to address body image issues and emotional distress.

Metformin remains the cornerstone of pharmacotherapy, reducing hepatic glucose production and improving insulin sensitivity. In 2025 studies, metformin demonstrated efficacy in restoring ovulation and reducing serum testosterone levels. Combined oral contraceptives containing low-dose estrogen and antiandrogenic progestins are recommended for women not seeking pregnancy. For infertility management, letrozole has surpassed clomiphene citrate as the first-line agent due to its higher live birth rate and fewer side effects. Spironolactone, finasteride, and cyproterone acetate may be used to manage hirsutism but require concurrent contraception to prevent teratogenic effects. Recent research explores the use of inositols, GLP-1 receptor agonists, and SGLT2 inhibitors as adjunctive therapies to improve metabolic profiles and reproductive outcomes.

In selected patients with drug-resistant anovulation, laparoscopic ovarian drilling (LOD) may restore spontaneous ovulation. However, its use has declined due to risks of ovarian damage. Modern adjunctive methods, such as low-level laser therapy and acupuncture, have shown potential benefits in improving ovulatory function and emotional balance.

Discussion

The management of PCOS requires an individualized, evidence-based, and multidisciplinary approach. Traditional symptom-oriented treatments are gradually being replaced by integrated strategies targeting the underlying metabolic and hormonal dysfunctions. The incorporation of precision medicine—based on genetic profiling and personalized metabolic assessment—represents a major trend in 2025. Moreover, patient education and long-term follow-up are critical to prevent chronic complications, such as type 2 diabetes, metabolic syndrome, and cardiovascular diseases.

In low- and middle-income countries, challenges persist due to limited access to diagnostic facilities and endocrinological care. Therefore, developing simplified screening protocols and public health programs remains a global priority.

Conclusion

PCOS is a complex, lifelong condition that requires early recognition and holistic management. Modern diagnostic and therapeutic approaches emphasize the importance of combining metabolic, reproductive, and psychosocial interventions. Lifestyle modification, metformin therapy, hormonal regulation, and ovulation induction remain the pillars of management. Emerging therapies targeting insulin resistance, inflammation, and neuroendocrine signaling hold promise for the future.

The interdisciplinary collaboration of gynecologists, endocrinologists, nutritionists, and psychologists is essential to optimize clinical outcomes and improve the quality of life for women with PCOS. Continuous research and innovation are necessary to translate new molecular discoveries into effective clinical practice.

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