

POLYCYSTIC OVARY SYNDROME (PCOS/PCOD): A COMPREHENSIVE REVIEW

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ABSTRACT

Polycystic Ovary Syndrome (PCOS), commonly referred to as Polycystic Ovarian Disease (PCOD), is a common endocrine disorder characterized by reproductive, hormonal and metabolic abnormalities. The condition may present with irregular menstrual cycles, ovulatory dysfunction, hyperandrogenism, acne, hirsutism, hair loss and fertility problems. Insulin resistance, hyperinsulinemia, abnormal androgen activity and altered ovarian function contribute to the pathophysiology of PCOS. PCOS is also associated with increased metabolic, cardiovascular, psychological and reproductive health risks. Diagnosis is based on clinical assessment, biochemical investigations and, when indicated, ovarian morphology assessment after excluding other causes of similar symptoms. The 2023 International Evidence-Based Guideline emphasizes individualized assessment, healthy lifestyle, metabolic risk evaluation, psychological wellbeing and evidence-based pharmacological management. Combined oral contraceptive pills may be used for menstrual irregularity and hyperandrogenic symptoms, while metformin has an important role in selected metabolic indications. Letrozole is recommended as the preferred first-line pharmacological treatment for ovulation induction in appropriate patients with PCOS-related anovulatory infertility. This review summarizes the etiology, pathophysiology, clinical manifestations, diagnosis, complications, management and emerging approaches in PCOS.^[1-5]

KEYWORDS: PCOS, PCOD, Polycystic Ovary Syndrome, Hyperandrogenism, Insulin Resistance, Menstrual Irregularity, Infertility, Metformin, Lifestyle Modification.

1. INTRODUCTION

Polycystic Ovary Syndrome (PCOS) is a heterogeneous endocrine disorder that affects women across the reproductive life course. It is associated with reproductive, metabolic, dermatological and psychological manifestations.^[1,2]

Although the term PCOD is commonly used, PCOS is the preferred scientific and clinical terminology. The condition should not be considered only an ovarian disorder because its manifestations extend beyond the ovaries.^[1,3]

Common features include irregular menstrual cycles, ovulatory dysfunction, clinical or biochemical hyperandrogenism, acne, hirsutism and fertility problems. Metabolic abnormalities such as insulin resistance and increased risk of impaired glucose

regulation may also occur.^[1,4]

The clinical presentation is heterogeneous; therefore, diagnosis and management should be individualized according to symptoms, metabolic risk and reproductive goals.^[1]

2. AIM AND OBJECTIVES**2.1 Aim**

To provide a comprehensive review of the pathophysiology, clinical manifestations, diagnosis, complications and management of PCOS/PCOD.

2.2 Objectives

1. To understand the basic concept of PCOS/PCOD.
2. To describe the etiology and risk factors.
3. To explain the pathophysiology of PCOS.
4. To summarize the clinical manifestations.

5. To discuss diagnostic criteria and investigations.
6. To describe associated complications.
7. To review pharmacological management.
8. To discuss lifestyle and dietary management.
9. To review herbal and complementary approaches.
10. To explain the role of pharmacists in PCOS management.
11. To discuss recent and emerging therapeutic approaches.

3. ETIOLOGY AND RISK FACTORS

The etiology of PCOS is multifactorial. Genetic susceptibility, endocrine abnormalities, insulin resistance, androgen excess and environmental/lifestyle factors may interact in the development of the disorder.^[3-6]

3.1 Genetic Factors

Family history may increase susceptibility to PCOS. Genetic factors are believed to interact with metabolic and environmental factors rather than acting as a single cause.^[4,5]

3.2 Insulin Resistance

Insulin resistance may result in compensatory hyperinsulinemia. Increased insulin activity can contribute to ovarian androgen production and reduced hepatic production of sex hormone-binding globulin (SHBG), thereby increasing free androgen levels.^[5,6]

3.3 Hyperandrogenism

Hyperandrogenism is an important feature of PCOS. Increased androgen activity may interfere with follicular development and normal ovulation, resulting in menstrual irregularity and other clinical manifestations.^[3,4]

3.4 Lifestyle Factors

Physical inactivity and unhealthy dietary patterns may contribute to metabolic abnormalities. However, PCOS can occur in individuals across different body sizes and should not be considered exclusively an obesity-related condition.^[1]

3.5 Obesity and Adiposity

Excess adiposity may aggravate insulin resistance and metabolic abnormalities in susceptible individuals. Management should focus on overall health and avoid weight stigma.^[1,7]

Table 1. Major Etiological and Risk Factors Associated with PCOS Factor | Possible Contribution.

Genetic predisposition | Increased susceptibility
 Insulin resistance | Hyperinsulinemia and metabolic abnormalities
 Hyperandrogenism | Abnormal follicular development
 Obesity/adiposity | May worsen insulin resistance
 Physical inactivity | May worsen metabolic health
 Unhealthy dietary pattern | May contribute to metabolic

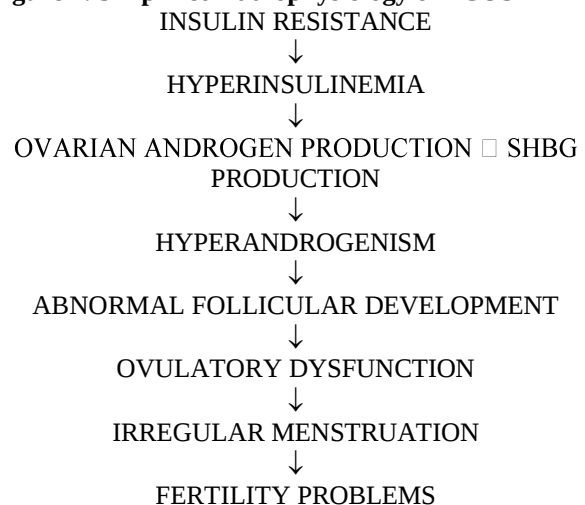
abnormalities Family history | Increased susceptibility

4. PATHOPHYSIOLOGY

The pathophysiology of PCOS involves complex interactions among insulin resistance, hyperinsulinemia, androgen production, ovarian follicular development and the hypothalamic-pituitary-ovarian axis.^[5,6]

Insulin resistance may lead to compensatory hyperinsulinemia. Increased insulin activity can stimulate ovarian androgen production and reduce hepatic SHBG production. This may result in increased circulating free androgens. Increased androgen activity can interfere with follicular maturation and ovulation.^[5,6]

Figure 1. Simplified Pathophysiology of PCOS



5. CLINICAL MANIFESTATIONS

The clinical presentation of PCOS varies considerably among individuals.^[1,4] Table 2. Clinical Manifestations of PCOS.

Clinical manifestation | Description

Irregular menstruation | Irregular or infrequent menstrual cycles

Oligo-ovulation | Infrequent ovulation

Hyperandrogenism | Increased androgen activity

Hirsutism | Excess facial/body hair

Acne | May occur due to androgen activity

Alopecia | Hair thinning/hair loss

Weight-related problems | Weight gain or difficulty

managing weight Infertility | May result from ovulatory dysfunction

Acanthosis nigricans | May indicate insulin resistance

Psychological symptoms | Anxiety, depression and reduced quality of life may occur

6. DIAGNOSIS

Diagnosis of PCOS requires appropriate clinical assessment and exclusion of other disorders that may produce similar symptoms.^[1,3]

6.1 Medical History

Important points include

- Menstrual history

- Age at menarche
- History of irregular cycles
- Acne and excessive hair growth
- Changes in body weight
- Fertility history
- Family history
- Medication history

6.2 Physical Examination

Assessment may include

- Body mass index (BMI)
- Waist circumference
- Blood pressure
- Clinical signs of hyperandrogenism
- Acanthosis nigricans
- Other relevant physical findings

6.3 Laboratory Investigations

Depending on clinical presentation, investigations may include

- Total and/or free testosterone
- Other androgen measurements
- TSH
- Prolactin
- 17-hydroxyprogesterone
- Glucose assessment/HbA1c
- Lipid profile

6.4 Ultrasonography

Pelvic ultrasonography may be used as part of the diagnostic assessment when appropriate.

In adults, AMH may also be used as an alternative to ultrasound for defining polycystic ovarian morphology, according to the 2023 guideline. However, AMH should be used within the overall diagnostic algorithm and is not required in every patient.^[1]

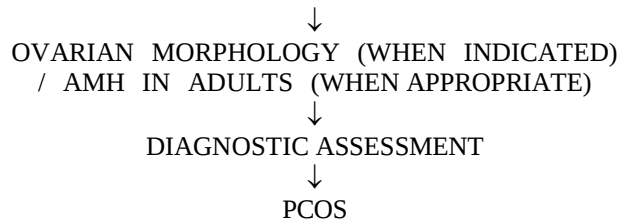
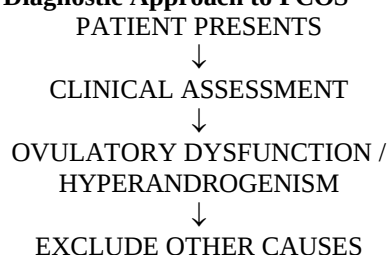
7. DIAGNOSTIC CRITERIA

The Rotterdam-based framework is an important foundation for PCOS diagnosis in adults after exclusion of alternative causes.^[1,3]

Generally, two of the following three features are considered:

1. **Ovulatory dysfunction**
2. **Clinical and/or biochemical hyperandrogenism**
3. **Polycystic ovarian morphology**

Figure 2: Diagnostic Approach to PCOS



8. COMPLICATIONS AND LONG-TERM HEALTH RISKS

PCOS is associated with reproductive, metabolic, cardiovascular, psychological and sleep-related health risks.^[1,4]

Table 3. Potential Complications Associated with PCOS
Complication/Risk | Significance

Infertility/subfertility | Often associated with ovulatory dysfunction
Impaired glucose tolerance | Increased metabolic risk

Type 2 diabetes mellitus | Increased risk in some individuals
Dyslipidemia | Abnormal lipid profile may occur
Cardiovascular risk factors | Multiple risk factors may coexist

Endometrial abnormalities | Prolonged anovulation can increase risk
Obstructive sleep apnea | Risk may be increased

Anxiety/depression | Psychological symptoms are more common
Pregnancy complications | Increased risk of adverse pregnancy outcomes

9. MANAGEMENT OF PCOS

Management should be individualized according to symptoms, metabolic health, reproductive goals and patient preferences.^[1]

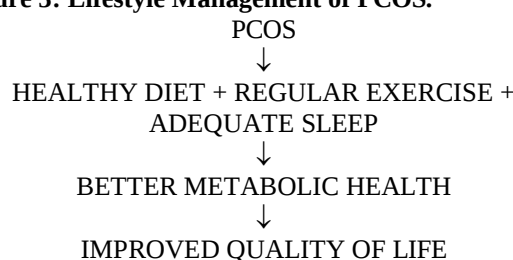
9.1 Lifestyle Modification

Lifestyle intervention is a core component of PCOS management. The 2023 guideline recommends healthy lifestyle behaviours and physical activity for individuals with PCOS to optimize general and metabolic health.^[1]

Important components include:

- Regular physical activity
- Balanced nutrition
- Adequate sleep
- Sustainable weight management when appropriate
- Reduction of excessive added sugars and highly processed foods
- Stress management
- Behavioural support when required

Figure 3: Lifestyle Management of PCOS.



10. PHARMACOLOGICAL MANAGEMENT

Table 4. Pharmacological Management of PCOS
Drug/Therapy | Major indication | Important consideration

Combined oral contraceptive pill | Menstrual irregularity/hyperandrogenism | Contraindications should be assessed

Metformin | Metabolic indications | Individualized use
Anti-androgens | Hirsutism in selected patients | Pregnancy prevention may be required

Letrozole | Ovulation induction | Preferred first-line pharmacological therapy for appropriate anovulatory infertility

Clomiphene + metformin | Selected infertility cases | Specialist supervision
Gonadotropins | Second-line fertility treatment | Monitoring required
IVF | Selected infertility cases | Specialist fertility care

10.1 Combined Oral Contraceptive Pills

Combined oral contraceptive pills may be used for menstrual cycle irregularity and clinical hyperandrogenism in suitable individuals who do not wish to become pregnant.^[1]

10.2 Metformin

Metformin is an insulin-sensitizing medicine with an important role in selected individuals, particularly for metabolic indications.^[1]

10.3 Anti-Androgen Therapy

Anti-androgenic medicines such as spironolactone may be considered for hirsutism in selected patients when appropriate. Contraception and monitoring are important because anti-androgens may pose fetal risks during pregnancy.^[1]

10.4 Ovulation-Inducing Therapy

For PCOS-related anovulatory infertility, letrozole is the preferred first-line pharmacological treatment for ovulation induction in the 2023 international guideline.^[1]

11. ROLE OF DIET AND EXERCISE

Healthy eating and physical activity are important components of PCOS management.^[1] Table 5. Lifestyle Components

Component | Recommendation

Diet | Balanced and sustainable healthy diet
Fruits & vegetables | Regular intake
Dietary fibre | Adequate intake

Refined carbohydrates | Avoid excessive intake
Added sugars | Limit excessive intake

Aerobic exercise | Regular activity

Resistance exercise | Include when appropriate
Sleep | Adequate sleep

Weight management | Individualized and health-focused
There is no single dietary composition proven to be superior for all individuals with PCOS. Lifestyle goals should be individualized.^[1]

12. HERBAL AND COMPLEMENTARY APPROACHES

Several complementary interventions have been studied in PCOS, including cinnamon, spearmint and inositol-containing supplements.

However, evidence varies between interventions and products. Therefore, herbal or dietary supplements should not automatically be considered safe or effective. They should not replace evidence-based medical treatment. Patients should discuss supplement use with a qualified healthcare professional, particularly during pregnancy planning or when taking other medicines.

13. RECENT AND EMERGING APPROACHES

Current PCOS research is focusing on:

1. Personalized treatment
2. Metabolic risk assessment
3. Digital health interventions
4. Novel approaches to insulin resistance
5. Improved fertility management
6. Gut microbiome research
7. Psychological health
8. Quality-of-life interventions

9. Long-term prevention of metabolic complications

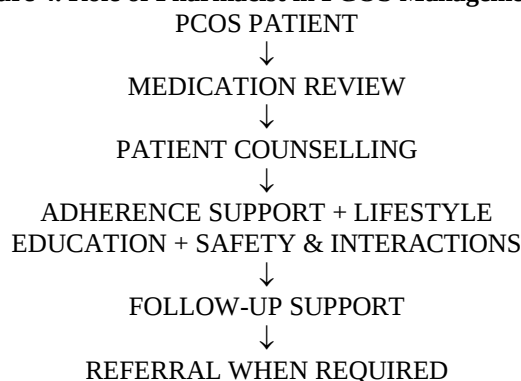
The 2023 guideline emphasizes broader assessment beyond reproductive symptoms, including metabolic, cardiovascular, psychological and sleep-related health.^[1]

14. ROLE OF PHARMACIST

Pharmacists can contribute to PCOS management through:

- Medication counselling
- Medication adherence support
- Adverse-effect counselling
- Drug-interaction assessment
- Lifestyle education
- Appropriate supplement counselling
- Patient education
- Referral to physicians when necessary

Figure 4. Role of Pharmacist in PCOS Management.



15. DISCUSSION

PCOS is a complex endocrine and metabolic condition with heterogeneous clinical manifestations. The interaction between hyperandrogenism, insulin resistance and abnormal ovarian function contributes to the clinical presentation.^[4-6]

Diagnosis requires appropriate clinical assessment and exclusion of alternative causes. The 2023 International Evidence-Based Guideline provides an updated diagnostic and management framework, including the use of AMH as an alternative to ultrasound for defining polycystic ovarian morphology in adults.^[1]

Lifestyle management remains an important component of long-term care. Pharmacological treatment should be selected according to the individual's symptoms and treatment goals. Combined oral contraceptive pills are useful for menstrual irregularity and hyperandrogenic symptoms, while metformin has an important role in selected metabolic indications. Letrozole is preferred for ovulation induction in appropriate patients with PCOS-related anovulatory infertility.^[1]

The multidisciplinary role of physicians, pharmacists, dietitians, psychologists and fertility specialists can support comprehensive management.

16. ADVANTAGES OF EARLY DIAGNOSIS AND MANAGEMENT

Early recognition and appropriate management may help to:

- Identify metabolic risk factors
- Manage menstrual irregularity
- Manage hyperandrogenic symptoms
- Address fertility concerns
- Improve lifestyle and metabolic health
- Identify psychological concerns
- Improve quality of life
- Support long-term health monitoring

17. LIMITATIONS

PCOS is a heterogeneous disorder, and individual responses to treatment vary. Evidence for some complementary and emerging interventions remains limited. Further high-quality clinical studies are required to establish the safety and efficacy of newer approaches.

18. CONCLUSION

Polycystic Ovary Syndrome is a common and complex endocrine disorder involving reproductive, metabolic and psychological health. Hyperandrogenism, ovulatory dysfunction and metabolic abnormalities are important components of the condition.

Accurate diagnosis requires appropriate clinical assessment and exclusion of alternative disorders. Management should be individualized and may include lifestyle modification, pharmacological therapy and

fertility-directed treatment.

Healthy lifestyle behaviours remain a fundamental component of long-term management. Pharmacists can support patients through medication counselling, adherence support, safety monitoring and health education.

Continued research is required to improve personalized treatment and long-term outcomes in individuals with PCOS.

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20. CONFLICT OF INTEREST

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