Open Access Library Journal
2024, Volume 11, e11773
ISSN Online: 2333-9721
ISSN Print: 2333-9705

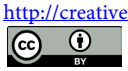
Overview of Polycystic Ovary Syndrome (PCOS)

Mahajabin Mahata

College of Basic Medical Science, China Three Gorges University, Yichang, China
Email: mahajabinmahata@ctgu.edu.cn

How to cite this paper: Mahata, M. (2024) Overview of Polycystic Ovary Syndrome (PCOS). *Open Access Library Journal*, **11**: e11773.
https://doi.org/10.4236/oalib.1111773

Received: June 3, 2024
Accepted: December 28, 2024
Published: December 31, 2024



Abstract

Polycystic Ovary Syndrome (PCOS) is a complicated endocrine condition marked by "irregularities in the reproductive system, metabolic problems, and hormone imbalances." A complex interaction of genetic predisposition, hyperandrogenism, insulin resistance, and chronic inflammation is responsible for the genesis of PCOS. Menstrual abnormalities, hirsutism, and metabolic syndrome are among the clinical signs of the condition that are caused by pathophysiological processes such as altered hypothalamic-pituitary-ovarian (HPO) axis function. PCOS diagnosis necessitates a thorough assessment taking into account imaging, biochemical, and clinical data; differential diagnosis entails separating PCOS from other gynecological and endocrine conditions. PCOS treatment plans are customized to each patient's unique symptoms and may involve supportive therapy, medication adjustments, and lifestyle changes. Healthcare professionals may maximize results and enhance the quality of life for PCOS-affected women by using a comprehensive approach to diagnosis and treatment.

Subject Areas

Gynecology & Obstetrics

Keywords

Ovulation Disorders, Hyperandrogenism, Polycystic Ovary, Obesity, Infertility, Metformin

1. Introduction

One of the most common endocrine illnesses affecting women who are of reproductive age is Polycystic Ovary Syndrome (PCOS), which presents a complicated constellation of symptoms and difficulties that go beyond issues with reproduction. It was first described by Stein and Leventhal in 1935 among women, and the prevalence ranges between 5% and 15% depending on the criteria applied to diagnosis [1]. With its complex etiology involving genetic predispositions, hormonal

abnormalities, and environmental variables, PCOS presents challenges for healthcare professionals globally in terms of diagnosis and treatment. Clinically manifested as androgen insufficiency, polycystic ovarian syndrome, and associated metabolic diseases such as obesity and insulin resistance. Polycystic ovary syndrome (PCOS) affects 5% - 20% of women of reproductive age worldwide [2]. The World Health Organization (WHO) data suggests that approximately 116 million women (3.4%) are affected by PCOS globally [3]. The pathophysiology of this condition reveals complex pathways that culminate in a variety of clinical symptoms due to the interaction of hyperandrogenism, insulin resistance, and chronic inflammation. A comprehensive and nuanced diagnostic approach is necessary to fully distinguish the intricacies of PCOS, since it appears across numerous systems, ranging from monthly abnormalities and infertility to metabolic changes and dermatological disorders including acne and hirsutism.

PCOS has many diverse manifestations, and there are many possible differential diagnoses to take into account when navigating the diagnostic landscape. Separating PCOS from other illnesses such as hyperprolactinemia, hypothalamic amenorrhea, and thyroid problems requires a thorough examination that includes imaging techniques, clinical observations, and hormonal measurements. After a diagnosis, PCOS requires much more than just managing symptoms; it also involves lifestyle changes, medication, and supportive therapies that are customized to the patient's unique requirements and reproductive objectives. The complexity of PCOS diagnosis and treatment makes it clear that a comprehensive strategy is needed, one that addresses the psychosocial effects and long-term health implications that individuals with the syndrome must deal with, in addition to addressing the physiological causes of the syndrome.

2. Etiology

Polycystic Ovary Syndrome (PCOS) has a complicated and multidimensional etiology that involves the interaction of hormonal, genetic, and environmental variables. Although the exact etiology of PCOS is still unknown, research has found a number of important processes that play a major role in its development. The dysregulation of the hypothalamic-pituitary-ovarian (HPO) axis, which is essential for metabolic and reproductive processes, lies at the heart of these pathways. The syndrome's many clinical symptoms are manifested by the interaction of key components such as insulin resistance, hyperandrogenism, and persistent low-grade inflammation. However, some previous studies show that PCOS could be linked to hereditary, lifestyle, and environmental factors that include early age of puberty, premature fetal development, family history of PCOS among first-degree relatives, physical inactivity, stress, and obesity among others [4].

2.1. Life Style Factors

High-calorie intake, high-sugar dite, sedentary lifestyle, causes obesity and weight

gain and we know that, obesity is a crucial risk-factor for PCOS and worsening the overall condition of the PCOS patient as obesity causes hyperinsulinemia that brutally influences glucose intolerance and lipid profile. Therefore, the effects of weight-gain on insulin resistance and hyperinsulinaemia, and the dysmetabolic and steroidogenic implications of the impaired PI3-kinase and intact MAP kinase post-receptor insulin pathways, respectively, form a central component of PCOS pathogenesis and underlie the association of weightgain and obesity with PCOS. [5].

2.2. Hereditary Factors and Genetical Factors

Study suggests that 35% of premenopausal women among 93 PCOS patients, 40% of their sisters were affected with this disorder. Another study proposed that among 80 women diagnosed with PCOS, 22% of their sisters were affected with PCOS while 24% of sisters had hyperandrogenemia with regular menses [6].

Genetical factors:Several genetic studies have revealed that several potential genes with single-nucleotide polymorphisms or mutations are connected to a variety of PCOS symptoms. PCOS is linked to all genes and mutations that directly or indirectly impact the ovaries [7]. There are almost 241 gene variations responsible for PCOS [8]. Although genetic factors are known to be involved in the pathogenesis of PCOS, it is estimated that the loci identified by GWAS account for less than 10% of its high heritability [9].

2.3. Fetal Environmental Factors

A child is more likely to develop PCOS during puberty if their mother has hypertension, a stress-related problem, obesity, diabetes, excess androgen, or if they smoke or consume packaged foods that contain chemicals. These conditions can also cause intrauterine development retardation. Girls whose mothers with PCOS are exposed to high levels of androgens throughout pregnancy. Daughters born to women with PCOS have a larger anogenital distance, which serves as a biomarker of intrauterine exposure to excess androgens, during the fetal and neonatal periods as well as in adulthood [10]-[13]. Environmental pollutants such as heavy metals, endocrine-disrupting chemicals (EDCs), insecticides, smoking cigarettes and PCOS have positive correlations in between. Except for that, Air pollutants, such as nitrogen oxides, sulfur dioxide, PAHs, and particulate matter (PM) 2.5, may increase inflammatory mediators in exposed women and alter normal steroidogenesis, which may contribute to the development of PCOS. Results from a population-based cohort study conducted in Taiwan Region showed that increased exposure to fine air pollutant particles and pollutant gases, namely SO_2, NO, NO_2, NOx, and PM2.5, was associated with increased PCOS risk [14]. According to recent research, the direct exposure of pregnant rats to either fungicide vinclozolin or insecticide DDT was associated with the development of ovarian abnormalities consistent with PCOS in three subsequent generations via epigenetic processes [15].

There is growing recognition that lifestyle and environmental variables play a

role in the genesis of PCOS. The onset and intensity of the syndrome can be influenced by endocrine-disrupting chemical exposure, physical exercise, and diet. In instance, obesity is a cause of PCOS as well as one of its effects. Overabundance of fat tissue aggravates hyperandrogenism and insulin resistance, setting off a vicious cycle that further damages reproductive and metabolic health. Furthermore, women with PCOS frequently have persistent low-grade inflammation, which is indicated by higher levels of inflammatory markers such interleukin-6 (IL-6) and C-reactive protein (CRP). It is believed that the malfunction of adipose tissue is the cause of this inflammatory condition, which may exacerbate insulin resistance and ovarian dysfunction. Understanding and treating PCOS requires a comprehensive approach due to the convergence of genetic, hormonal, and environmental components in its genesis.

In summary, a dynamic and multifaceted process involving the interaction of genetic predisposition, hormone imbalances, insulin resistance, and environmental factors leads to the genesis of PCOS. The pathophysiology of PCOS is largely influenced by hyperandrogenism and insulin resistance, which emphasizes how closely related the syndrome's metabolic and reproductive problems are. In order to fully comprehend the complexity of PCOS causation, advances in genetic research and a greater comprehension of environmental and lifestyle components will be essential. This thorough knowledge is necessary to provide focused therapies, enhance PCOS management, and ultimately improve the lives of impacted women. The goal of future research should be to develop individualized and efficient treatment plans by delving further into the molecular processes behind PCOS and the effects of lifestyle and environmental changes.

3. Pathophysiology

An endocrine illness known as polycystic ovary syndrome (PCOS) is a complicated combination of environmental, hormonal, and genetic variables. The dysregulation of the hypothalamic-pituitary-ovarian (HPO) axis, which results in anovulation and hyperandrogenism, is at the core of its pathogenesis. Complex hormonal dysregulation linked to PCOS presents as a range of metabolic and reproductive disorders. The pathophysiological processes that underlie the syndrome are multifaceted, with key roles being played by insulin resistance, hyperandrogenism, and chronic low-grade inflammation in its development and persistence.

One of PCOS's defining characteristics and a major factor in its clinical manifestations is hyperandrogenism. Androgens, which are mostly generated by the ovaries and, to a lesser degree, the adrenal glands, include testosterone and androstenedione, are frequently seen in increased quantities in women with PCOS. The increased activity of cytochrome P450c17α, an enzyme essential for androgen production, is the cause of the elevated androgen levels. The anovulation and numerous ovarian cyst formation that result from this hyperandrogenic condition are caused by the disruption of normal follicular development. Alopecia, acne,

and hirsutism are examples of dermatological problems caused by hyperandrogenism. Additionally, the extra androgens worsen insulin resistance, setting off a vicious cycle in which hyperinsulinemia increases the synthesis of androgens in the ovaries. The interaction between insulin resistance and hyperandrogenism highlights the intricate pathophysiology of PCOS.

An important aspect of PCOS that affects a large number of women with the illness is insulin resistance. A hallmark of insulin resistance in PCOS is the body's reduced ability to react to insulin, which causes hyperinsulinemia when the pancreas secretes more insulin to make up for it. By working in concert with luteinizing hormone (LH) to activate theca cells in the ovaries, hyperinsulinemia enhances the synthesis of androgen in the ovaries. Furthermore, insulin raises levels of free, physiologically active androgens by blocking the hepatic synthesis of sex hormone-binding globulin (SHBG). Defects in insulin receptor signaling and post-receptor pathways, such as decreased tyrosine kinase activity and altered glucose transporter (GLUT) function, are the basic processes underpinning insulin resistance in PCOS. There is a strong genetic component to insulin resistance in PCOS; several susceptibility loci that affect insulin signaling and glucose metabolism have been found. Insulin resistance puts PCOS-afflicted women at risk for metabolic diseases including type 2 diabetes, obesity, and cardiovascular disease in addition to exacerbating hyperandrogenism.

Another important component in the pathogenesis of PCOS is persistent low-grade inflammation. Inflammatory indicators such as C-reactive protein (CRP), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF-α) are higher in women with PCOS. Excessive fat, especially visceral fat, is assumed to be the cause of an inflammatory condition since it secretes adipokines and pro-inflammatory cytokines. In PCOS, dysfunctional adipose tissue plays a role in both metabolic and reproductive issues. By disrupting insulin signaling pathways, the inflammation linked to PCOS makes insulin resistance worse and prolongs hyperinsulinemia and hyperandrogenism. Furthermore, changes in steroidogenesis and folliculogenesis might result from inflammatory cytokines' direct impact on ovarian function. The connection between PCOS and chronic inflammation emphasizes the systemic character of the illness and its effects on many physiological systems. Comprehending the part played by inflammation in PCOS provides opportunities for therapeutic therapies aimed at inflammatory pathways to alleviate symptoms related to metabolism and reproduction.

In summary, insulin resistance, chronic inflammation, and hormone abnormalities all play intricate roles in the pathophysiology of PCOS, resulting in a variety of clinical symptoms. Normal ovarian function and metabolic processes are disrupted by hyperandrogenism, and androgen production and metabolic difficulties are made worse by insulin resistance and hyperinsulinemia. These disruptions are further exacerbated by persistent low-grade inflammation, resulting in a complex condition with systemic effects. In order to create targeted therapeutics and enhance the clinical results for women with PCOS, it is imperative that we

further our understanding of these pathophysiological pathways. Subsequent investigations ought to concentrate on clarifying the molecular foundations of these mechanisms and investigating innovative approaches that tackle the underlying reasons of PCOS, with the objective of offering more efficient and customized therapeutic approaches. Figure 1 shows factors that have potential impact on pathophysiology of PCOS.

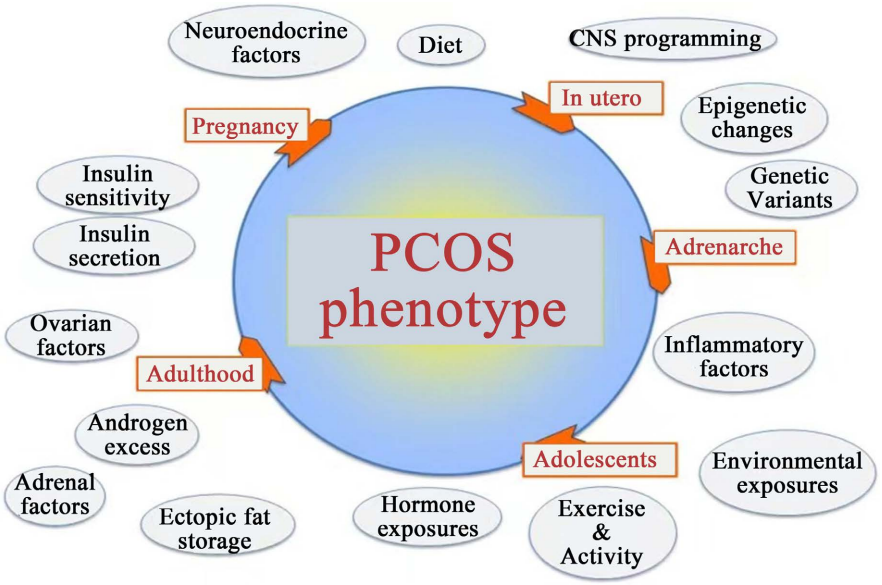


Figure 1. Factors contributing to PCOS phenotype. PCOS encompasses a woman's life cycle. Factors potentially impacting the pathophysiology of PCOS are shown in circles. Not all factors affect each individual. PCOS epitomizes a biologic network of interacting neuroendocrine, hormonal, metabolic, genetic, and environmental influences [16].

4. Clinical Manifestations

The clinical signs of Polycystic Ovary Syndrome (PCOS) are diverse, indicating the complicated and heterogeneous character of the condition. Reproductive, metabolic, and dermatological symptoms are the outcome of the syndrome's impact on several bodily systems. These symptoms might differ greatly from person to person, which makes it more difficult to diagnose and treat the illness. In order to create comprehensive and customized treatment strategies, healthcare practitioners must have a thorough understanding of the range of clinical aspects associated with this disease. PCOS may present as ovarian dysfunction and menstrual irregularities, obesity along with signs of androgen excess such as hirsutism, acne and alopecia, and polycystic ovaries on imagining in females. PCOS is a common cause of infertility and puts females at risk of developing type 2 diabetes, and endometrial cancer [17].

Reproductive dysfunction or Infertility: PCOS is characterized by reproductive abnormalities, of which irregular menstruation is one of the most prevalent symptoms. Because of prolonged anovulation, women with PCOS frequently have oligomenorrhea (infrequent menstrual cycles) or amenorrhea (lack of menstrual

periods). The imbalance in the hypothalamic-pituitary-ovarian (HPO) axis, which is defined by increased luteinizing hormone (LH) and relatively low follicle-stimulating hormone (FSH) levels, is the cause of the impaired ovarian function. This hormonal imbalance prevents oocytes from developing and releasing normally, which results in infertility a serious worry for a large number of PCOS-affected women. Infertility was noted in 72% of women with PCOS and 16% of women without PCOS [18].

Type 2 Diabetic Symptoms: Fatigue, frequent urination, increased thirst or hunger, acanthosis nigricans, tingling sensation in the hand and feet are primary symptoms of diabetes.

HIRSUITISM: The primary cause of PCOS's dermatological symptoms is hyperandrogenism, which leads to disorders like hirsutism, which is characterized by an excess of terminal hair growth in women's masculine pattern distribution. Depending on ethnicity, a modified Ferriman-Gallwey score ≥ 4 to 6 indicates hirsutism [19]. Most women with PCOS experience hirsutism, which is the excessive growth of coarse hair in a masculine pattern distribution and can have serious psychological effects. By measuring hair growth in different body parts, the Ferriman-Gallwey score may be used to determine the degree of hirsutism.

Acne: Another typical symptom is acne, which frequently seems severe, chronic, and unresponsive to standard therapies. Acne and blocked pores are caused by sebaceous gland activity being stimulated by elevated androgen levels. Male-pattern hair loss, or androgenic alopecia, is characterized by thinning hair on the scalp, especially in the frontal and crown regions. These dermatological conditions have a significant psychological impact in addition to their medical repercussions, which is why women with PCOS often experience melancholy, anxiety, and low self-esteem. A comprehensive strategy including dermatological therapies and psychological assistance is needed to address these problems.

Symptoms of Hyperinsulinemia and hyperandroginism: Insulin production is stimulated by an increased amount in androgens. Hyperinsulinemia and insulin resistance rise the response to increased insulin production. Enhanced insulin induces the liver to produce less sex hormone-binding globulin, which raised the amount of testosterone in blood. The production of androgen is boosted in the ovary's theca cells, A raise in insulin also causes the pituitary to release more LH and less FSH. Inflammation brought on by insulin resistance and hyperinsulinemia raises the risk of type 2 diabetes and cardiovascular disease and result in weight gain.

In the end, PCOS can present with a wide range of clinical symptoms in the metabolic, dermatological, and reproductive domains. Hormonal abnormalities and prolonged anovulation are the main causes of infertility and irregular menstruation. The systemic character of PCOS is highlighted by metabolic abnormalities, which include obesity, dyslipidemia, insulin resistance, and a higher risk of type 2 diabetes and cardiovascular disease. A person's quality of life is greatly impacted by dermatological symptoms such hirsutism, acne, and androgenic alopecia, which are direct results of hyperandrogenism. A comprehensive strategy that

takes into account all of these factors is necessary for the comprehensive management of PCOS, and treatment strategies should be customized to meet the specific needs of each woman. To enhance the general health and wellbeing of women with PCOS, future research should concentrate on clarifying the underlying processes of these clinical aspects and creating tailored therapeutics.

5. Diagnosis

Polycystic Ovary Syndrome (PCOS) diagnosis is a complex process that includes biochemical assessments, a comprehensive clinical examination, and ruling out other conditions that may be causing the same symptoms as PCOS. Because PCOS is so variable, making a diagnosis can be difficult. Several diagnostic standards have been established in order to guarantee a thorough method of diagnosing this illness and to standardize the diagnosis. The National Institutes of Health (NIH), the Androgen Excess and PCOS Society (AE-PCOS), and the Rotterdam criteria are the most often utilized ones. The strengths and limitations of each set of criteria impact the clinical care options and prevalence estimations.

The Rotterdam criteria, established in 2003, are often employed in clinical practice and study. As per these criteria, oligo- or anovulation, clinical and/or biochemical evidence of hyperandrogenism, and polycystic ovaries seen on ultrasound are the three symptoms that must be present for a diagnosis of PCOS. The assessment of oligo- or anovulation is usually based on a woman's past irregular menstrual cycles. Clinical manifestations of hyperandrogenism include hirsutism, acne, and androgenic alopecia, as well as high blood androgen levels. The existence of 12 or more follicles with diameters ranging from 2 to 9 mm and/or an enlarged ovarian volume (>10 cm^3) on ultrasonography are indicative of polycystic ovaries. The significance of ultrasound imaging in PCOS diagnosis is acknowledged by the addition of polycystic ovarian morphology as a criteria. In 2012, the NIH held an evidence-based methodology workshop on PCOS, in which experts on PCOS again recommended use of the broader 2003 Rotterdam criteria, while specifically identifying sub-phenotypes within these criteria of (1) androgen excess and ovulatory dysfunction, (2) androgen excess and PCOM, (3) ovulatory dysfunction and PCOM, and (4) androgen excess, ovulatory dysfunction and PCOM [20].

The 1990 NIH criteria are stricter and exclude polycystic ovarian morphology as a diagnostic criterion for PCOS. Instead, they require the presence of both hyperandrogenism and oligo- or anovulation. With an emphasis on the fundamental clinical and biochemical characteristics of PCOS, this method seeks to lower the risk of overdiagnosis. When it comes to identifying women who have more prominent PCOS symptoms, the NIH criteria are very helpful in enabling focused care. On the other hand, women with polycystic ovarian morphology without severe hyperandrogenism or irregular menstruation may go undiagnosed if ultrasound findings are ignored. This drawback emphasizes the necessity of a well-rounded diagnostic strategy that takes into account the whole range of PCOS symptoms.

The Androgen Excess and PCOS Society devised the AE-PCOS criteria. The AES guidelines, required the presence of hirsutism and/or biochemical hyperandrogenism, as well as either oligo-anovulation and/or polycystic-appearing ovarian morphology (PCOM) for the diagnosis of PCOS [21]. By combining ultrasonography and clinical data, this set of criteria seeks to strike a compromise while highlighting the significance of androgen excess. By providing a more thorough evaluation of PCOS traits, the AE-PCOS criteria address some of the shortcomings of the Rotterdam and NIH criteria. However, because laboratory standards can vary and precise tests are required to identify small anomalies, relying solely on biochemical testing for androgen levels might provide difficulties.

A comprehensive assessment for PCOS includes a full medical history, physical examination, and rule out other illnesses that resemble PCOS symptoms in addition to the recognized diagnostic criteria. Menstrual abnormalities, hirsutism, acne, weight fluctuations, and a family history of PCOS or similar metabolic diseases should all be evaluated as part of a thorough medical history. A physical examination should concentrate on hirsutism and acne, two symptoms of hyperandrogenism, and measure the patient's waist circumference and body mass index (BMI) to check for central obesity. Measuring blood androgen levels, such as total testosterone, free testosterone, and dehydroepiandrosterone sulfate (DHEAS), requires laboratory testing. To rule out other endocrine diseases, further testing may include measures of prolactin, thyroid-stimulating hormone (TSH), follicle-stimulating hormone (FSH), and luteinizing hormone (LH). Insulin resistance can be measured by oral glucose tolerance tests (OGTT), homeostatic model assessment for insulin resistance (HOMA-IR), or fasting glucose and insulin levels.

Examining ovarian morphology is a critical function of imaging tests, especially transvaginal ultrasonography. Multiple tiny follicles (12 or more) and increased ovarian volume are ultrasound criteria for polycystic ovaries. The accuracy of ovarian evaluations can be improved by utilizing modern imaging techniques including magnetic resonance imaging (MRI) and three-dimensional ultrasound. However, there should be caution when interpreting ultrasound results, especially in young women and teenagers when polycystic ovarian morphology may be a normal finding.

In summary, using recognized diagnostic criteria as a guide, a thorough integration of clinical, biochemical, and imaging results is necessary for the diagnosis of PCOS. Three useful frameworks for diagnosing PCOS the Rotterdam, NIH, and AE-PCOS criteria each place a distinct focus on certain clinical characteristics. Accurate diagnosis requires a thorough evaluation that involves a thorough medical history, physical examination, and rule out other illnesses. Though PCOS is heterogeneous, advances in imaging and laboratory methods continue to enhance the diagnostic process; however, a tailored approach to diagnosis and care is necessary. In order to improve the accuracy and consistency of PCOS diagnosis and, eventually, the quality of life for afflicted women, future research should concentrate on enhancing diagnostic criteria and creating standardized methodologies.

6. Differential Diagnosis

Differentiating Polycystic Ovary Syndrome (PCOS) from other disorders with comparable clinical characteristics is a crucial step in the diagnostic process. Because PCOS is diverse and shares symptoms with a number of endocrine and gynecological problems, a thorough assessment is required to rule out other possible diagnosis. Congenital adrenal hyperplasia (CAH), hyperprolactinemia, hypothalamic amenorrhea, thyroid issues, and androgen-secreting tumors are common diseases considered in the differential diagnosis of PCOS.

Hypothalamic Dysfunction Vs PCOS: The lack of menstruation as a result of hypothalamic dysfunction which is frequently brought on by intense activity, stress, or low body weight is known as hypothalamic amenorrhea. Hypothalamic amenorrhea, PCOS usually manifests as low levels of both FSH and LH, indicating a hypogonadal condition. Furthermore, because of the peripheral aromatization of androgens, women with PCOS may have normal or high levels of estradiol, whereas women with hypothalamic amenorrhea frequently have low amounts.

Hyperprolactinemia Vs PCOS: The pituitary gland's overproduction of prolactin results in hyperprolactinemia, which might resemble some PCOS symptoms including irregular menstruation and galactorrhea. Nonetheless, laboratory testing can show that hyperprolactinemia is linked to elevated blood prolactin levels. In situations of hyperprolactinemia, imaging tests like magnetic resonance imaging (MRI) may also detect pituitary adenomas or other structural anomalies of the pituitary gland.

Thyroid disease Vs PCOS: PCOS symptoms can coexist with thyroid issues, such as hypothyroidism and hyperthyroidism, which can cause weight fluctuations, tiredness, and irregular menstruation. Diagnosing thyroid diseases requires thyroid function tests, which include measuring levels of free thyroxine (FT4) and thyroid-stimulating hormone (TSH). Additionally, to check for structural abnormalities of the thyroid gland, imaging investigations such thyroid ultrasonography could be necessary.

Congenital Adrenal Hyperplasia (CAH) Vs PCOS: A class of hereditary diseases known as congenital adrenal hyperplasia (CAH) is defined by a deficiency in cortisol synthesis, which leads to an overabundance of adrenal androgen production. In its traditional form, infantile CAH manifests as virilization and salt-wasting symptoms. In less severe variations, including non-classic CAH, symptoms like hirsutism and irregular menstruation may appear later in life and cross over with PCOS symptoms. The diagnosis of CAH can be aided by measurements of blood 17-hydroxyprogesterone levels and adrenal imaging investigations.

Adrenal or ovarian cancers Vs PCOS: Adrenal or ovarian cancers are examples of tumors that secrete androgens, which can induce hyperandrogenism and resemble PCOS symptoms. Though uncommon, these tumors should be taken into account in women who experience severe or quickly developing hyperandrogenism symptoms. Tumors can be detected by imaging tests such as magnetic resonance imaging (MRI), computed tomography (CT) of the adrenal glands, and pelvic

ultrasonography (US). Serum androgen measurements are crucial for differentiating androgen-secreting tumors from PCOS, in addition to other hormonal evaluations.

Finally, a number of endocrine and gynecological disorders that have comparable clinical characteristics must be carefully taken into account when making a differential diagnosis of PCOS. Accurate diagnosis requires a thorough evaluation that includes a thorough medical history, physical examination, blood work, and imaging investigations. Working together, endocrinologists, gynecologists, and radiologists may be required to distinguish PCOS from other conditions and guarantee proper treatment. Optimizing patient treatment can be achieved by reducing misdiagnosis and increasing knowledge of the differential diagnosis of PCOS and applying a methodical approach to examination.

7. Treatment

The first-line treatment for PCOS has been lifestyle interventions; however, major clinical features such as acne, hirsutism, menstrual irregularities, and anovulation require pharmacological treatment that includes contraceptives, such as COC and progestin-only contraceptives, and infertility drugs, such as letrozole or clomiphene, metformin, and spironolactone [22]. Reproductive, metabolic, and dermatological problems are among the many clinical aspects of the illness that are targeted by the comprehensive therapeutic approach. PCOS treatment plans are tailored to each patient's unique symptoms, reproductive objectives, and general health. The comprehensive care of polycystic ovary syndrome (PCOS) involves lifestyle adjustments, pharmaceutical interventions, and supportive therapies with the goals of mitigating long-term health risks, improving symptoms, and restoring hormonal balance.

7.1. Lifestyle Modifications

1. Dietary Changes: Women with PCOS can improve their metabolic parameters and control their weight by implementing a balanced diet high in fruits, vegetables, whole grains, and lean meats. Reducing sugary and refined carbohydrate consumption may also aid in controlling insulin levels and lowering hyperinsulinemia.

2. Regular Exercise: Regular physical activity can improve general cardiovascular health, increase insulin sensitivity, and encourage weight reduction. Examples of this type of exercise include yoga, strength training, and aerobics. Try to get in at least 150 minutes a week of moderate-to-intense activity.

3. Weight Management: For overweight or obese women with PCOS, weight loss through calorie restriction and increased physical activity is recommended as first-line therapy. According to research, reducing up to 5% of one's initial weight can help restore regular menstruation and boost the reaction to ovulation and reproductive medications [23].

7.2. Pharmacological Treatments

1) Oral Contraceptives (OCPs): Women with PCOS who want to control their

menstrual periods and lower their testosterone levels can take combination oral contraceptives that contain progestin and estrogen. Moreover, OCPs can reduce hirsutism and acne by inhibiting the synthesis of androgen in the ovaries.

2) Anti-androgens: By preventing the effects of androgens on certain tissues, drugs like spironolactone and cyproterone acetate are useful in treating hirsutism, acne, and alopecia. For best effects, these medicines are frequently used in conjunction with OCPs.

3) Metformin: Metformin, a biguanide antidiabetic agent. It is found that, Metformin is very effective and safe for improving insulin resistance, menstrual cycle irregularities, acne, and symptoms of hyperandrogenism like hirsutism, decreases ovarian androgen production by 20% to 25% in PCOS patients [24]. It enhances insulin sensitivity and helps women with PCOS, especially those with insulin resistance or reduced glucose tolerance, control metabolic abnormalities. Additionally, metformin may enhance menstrual regularity and reestablish ovulatory activity.

It is normal practice to induce ovulation and encourage follicular growth using drugs like letrozole or clomiphene citrate. Women who do not react to oral treatment may be candidates for gonadotropin injections.

7.3. Surgical Interventions

Ovarian Drilling: Electrocautery or lasers are used in laparoscopic ovarian drilling, a minimally invasive surgical technique, to make tiny punctures in the ovarian surface. In PCOS women, ovarian drilling can enhance ovulatory function and fertility, especially in those who do not respond well to medication.

7.4. Supportive Therapies

1. Psychological Support: Patients with PCOS likely suffer from a wide range of psychological problems like low self-esteem, mood swings, depression, anxiety, and even psychosis. In PCOS, acne and hirsutism are the most common markers of affecting the quality of life by worsening the emotional well-being of women [24]. It is necessary for all-encompassing management. Support groups, cognitive-behavioral therapy, and counseling can assist women in managing the emotional difficulties brought on by PCOS.

2. Nutritional counseling: Women with PCOS can benefit from individualized nutritional advice and assistance for managing their weight, addressing insulin resistance, and improving their metabolic health by working with a licensed dietitian or nutritionist. Meal planning and nutrition education can enable patients to achieve long-lasting lifestyle adjustments.

3. Fertility Counseling: To improve their reproductive health, women with PCOS who intend to become pregnant should get preconception counseling. On ovulation induction, assisted reproductive technologies (ART), and lifestyle variables that may affect fertility results, fertility professionals can offer advice.

7.5. Long-Term Management

1. Regular Follow-up: In order to evaluate the effectiveness of treatment and make any adjustments to management techniques, women with PCOS need to have their symptoms, metabolic parameters, and reproductive health regularly monitored. Weight, blood pressure, glucose tolerance, lipid profiles, and menstrual cycles should all be evaluated annually.

2. Preventive Health Measures: Dyslipidemia, hypertension, and diabetes screenings are crucial since women with PCOS are more likely to develop metabolic syndrome, type 2 diabetes, and cardiovascular disease. To lower long-term health risks, pharmaceutical therapies and lifestyle modifications may be started.

To sum up, a comprehensive strategy is employed to treat the reproductive, metabolic, and psychological components of Polycystic Ovary Syndrome (PCOS). The mainstay of therapy consists of supportive treatments, pharmaceutical interventions, and lifestyle changes with the goals of lowering long-term health risks, reestablishing hormonal balance, and improving symptoms. For women with PCOS, individualized treatment regimens that are based on their unique requirements and objectives are crucial to improving quality of life and maximizing results. Research and clinical developments will keep improving treatment approaches and the overall care of this difficult ailment (See Table 1).

Table 1. Shows symptom, treatment, dosing or recommendation [25].

Symptom	Treatment	Dosing or recommendation	Clinical considerations
Menstrual irregularity, heavy bleeding	First-line		
	Lifestyle interventions	Diet and exercise aimed at weight reduction by 5% - 10% or prevention of excess weight gain	Be aware of weight stigma and increased risk for disordered eating
	CHCs	Any form	
	Progestins		
	Progestins		
	Oral norethindrone acetate	5 mg daily for 7 d every 30 - 90 d or 5 mg daily for 3 wk on, 1 wk off	
	acetate	daily for 3 wk on, 1 wk off	
	Oral drospirenane	4 24 d. 4d placebo	
	Oral drospirenane	4 mg 24 d. 4d placebo	
	Oral dienogest	2 mg daily	May cause breakthrough bleedingPatients may continue to have irregular,
	Levonorgestrel	52 mg released over 5 yr	
	Etonogestrel subdermal implant	68 mg released over 3 yr	Patients may continue to have irregular, although lighter, bleeding
	Intramuscular medroxyprogesterone acetate	150 mg intramuscularly every 3 mo	
	Intramuscular medroxyprogesterone acetate	150 mg intramuscularly every 3 mo	

Continued

	Alternative options		
	Metformin	1500 - 2000 mg daily in divided doses	Start at 500 mg and increase by 500 mg every
		mg	mg every1 - 2 wk Cannot be used for endometrial protectionin the event of amenorrhea but may helpinduce regular ovulation
	Inositol	Dosing varies 4 g of myo-inositol with a 40:1 ratio between myo-inositol and D-chiro-inositol daily	Cannot be used for endometrial protectionin the event of amenorrhea but may help induce regular ovulation
		4 g of myo-inositol with a 40:1 ratio between myo-inositol and D-chiro-inositol daily	in the event of amenorrhea but may helpinduce regular ovulation
Acne, hirsutism or alopecia	First-line		Can be used during or before external hairremoval methods
	CHCs	Any form	
	CHCs	Any form	
	Topical hirsutism treatment	13.0% eflomithine	
	Minoxidil (for alopecia)	2% twice daily	
	Topical or oral acne	According to general guidelines	
	Topical or oral acne treatments methods	According to general guidelines	
	Alternative options Spironolactone	50 - 100 mg twice daily	Must be used with effective contraception given teratogenicity (*i.e.*, CHCs or progestin-based
	Spironolactone	50 - 100 mg twice daily	Must be used with effective contraception given teratogenicity (*i.e.*, CHCs or progestin-based contraception if CHCs are contraindicated Do not use in combination with CHC containing dropirenone Requires monitoring with electrolytes 3 mo after starting and then annually and with
	Finasteride	5 mg daily	Must be used with effective contraceptiongiven teratogenicity (*i.e.*, CHCs or progestin-based contraception if CHCs contraindicated)
Symptom	**Treatment**	**Dosing or recommendation**	**Clinical considerations**
Overweight or obesity	First-line		
	Lifestyle interventions	Diet and exercise aimed at weight reduction by 5% - 10% or prevention of excess weight gain	Be aware of weight stigma and increased risk for disordered eating

Continued

Ovulation induction	Metformin	1500 - 2000 mg daily in divided doses	Start at 500 mg and increase by 500 mg every 1 - 2 wk
	Alternative options		
	Inositol	Dosing varies 4 g of MI with a 40:1 ratio between myo-inositol and D-chiro-inositol daily"	
	Anti-obesity medications or surgery		According to general guidelines
	First-line		
	Lifestyle interventions	Diet and exercise aimed at weight reduction by 5% - 10% or prevention of excess weight gain	Be aware of weight stigma and increased risk for disordered eating
	Metformin	1500 - 2000 mg daily in divided doses	Start at 500 mg and increase by 500 mg every 1 - 2 wk
	Letrozole	2.5 mg - 7.5 mg for 5 d	Although considered first-line by many guidelines still considered as off-label use in Canada lf cycling regularly, start on day 2 - 5 lfirregular cycles, can start randomly after negative home pregnancy test or medroxyprogesterone-induced withdrawal bleed Consider measuringserum progesteronelevel 3 wk after starting letrozole to confirmovulation
	Alternative options		
	Inositol	Dosing varies; 4 g of myo-inositol with a 40:1 ratio between myo-inositol and D-chiro-inositol daily	
	Referral to gynecologist or reproductive endocrinologistand infertility specialist		

8. Conclusion

Women's health faces a variety of challenges due to Polycystic Ovary Syndrome (PCOS), which is marked by a complex interaction of metabolic, dermatological, and reproductive aspects. The wide range of clinical manifestations of the condition, from insulin resistance and hirsutism to irregular menstruation and infertility, highlight the necessity of a thorough and customized approach to diagnosis and treatment. Research advances have expanded our knowledge of the pathophysiology of PCOS and opened the door to novel treatment approaches that target the underlying hormonal imbalances, metabolic disorders, and psychological

effects of the condition. In order to optimize PCOS care, increase the accuracy of diagnoses, and improve patient outcomes, ongoing collaboration between healthcare practitioners, researchers, and patients is necessary. Through individualized treatment programs and comprehensive support, we can meet the specific requirements of women with PCOS and enable them to effectively manage their disease and improve their overall health and well-being.

Conflicts of Interest

The author declares no conflicts of interest.

References

[1] Rasquin, L.I., Anastasopoulou, C. and Mayrin, J.V. (2017) Polycystic Ovarian Disease. StatPearls Publishing. https://europepmc.org/article/NBK/nbk459251

[2] McDonnell, R. and Hart, R.J. (2017) Pregnancy-Related Outcomes for Women with Polycystic Ovary Syndrome. *Women's Health*, **13**, 89-97. https://doi.org/10.1177/1745505717731971

[3] Bulsara, J., Patel, P., Soni, A. and Acharya, S. (2021) A Review: Brief Insight into Polycystic Ovarian Syndrome. *Endocrine and Metabolic Science*, **3**, Article ID: 100085. https://doi.org/10.1016/j.endmts.2021.100085

[4] Jabeen, A., Yamini, V., Rahman Amberina, A., Dinesh Eshwar, M., Vadakedath, S., Begum, G.S., *et al.* (2022) Polycystic Ovarian Syndrome: Prevalence, Predisposing Factors, and Awareness among Adolescent and Young Girls of South India. *Cureus*, **14**, e27943. https://doi.org/10.7759/cureus.27943

[5] Barber, T.M., Hanson, P., Weickert, M.O. and Franks, S. (2019) Obesity and Polycystic Ovary Syndrome: Implications for Pathogenesis and Novel Management Strategies. *Clinical Medicine Insights*: *Reproductive Health*, **13**, 3. https://doi.org/10.1177/1179558119874042

[6] Siddiqui, S., Mateen, S., Ahmad, R. and Moin, S. (2022) A Brief Insight into the Etiology, Genetics, and Immunology of Polycystic Ovarian Syndrome (PCOS). *Journal of Assisted Reproduction and Genetics*, **39**, 2439-2473. https://doi.org/10.1007/s10815-022-02625-7

[7] Khan, M.J., Ullah, A. and Basit, S. (2019) Genetic Basis of Polycystic Ovary Syndrome (PCOS): Current Perspectives. *The Application of Clinical Genetics*, **12**, 249-260. https://doi.org/10.2147/tacg.s200341

[8] Ajmal, N., Khan, S.Z. and Shaikh, R. (2019) Polycystic Ovary Syndrome (PCOS) and Genetic Predisposition: A Review Article. *European Journal of Obstetrics & Gynecology and Reproductive Biology*: *X*, **3**, Article ID: 100060. https://doi.org/10.1016/j.eurox.2019.100060

[9] Harada, M. (2022) Pathophysiology of Polycystic Ovary Syndrome Revisited: Current Understanding and Perspectives Regarding Future Research. *Reproductive Medicine and Biology*, **21**, e12487. https://doi.org/10.1002/rmb2.12487

[10] Barrett, E.S., Hoeger, K.M., Sathyanarayana, S., Abbott, D.H., Redmon, J.B., Nguyen, R.H.N., *et al.* (2018) Anogenital Distance in Newborn Daughters of Women with Polycystic Ovary Syndrome Indicates Fetal Testosterone Exposure. *Journal of Developmental Origins of Health and Disease*, **9**, 307-314. https://doi.org/10.1017/s2040174417001118

[11] Perlman, S., Toledano, Y., Kivilevitch, Z., Halevy, N., Rubin, E. and Gilboa, Y. (2020)

Foetal Sonographic Anogenital Distance Is Longer in Polycystic Ovary Syndrome Mothers. *Journal of Clinical Medicine*, **9**, Article No. 2863. https://doi.org/10.3390/jcm9092863

[12] Sánchez-Ferrer, M.L., Mendiola, J., Hernández-Peñalver, A.I., Corbalán-Biyang, S., Carmona-Barnosi, A., Prieto-Sánchez, M.T., *et al.* (2017) Presence of Polycystic Ovary Syndrome Is Associated with Longer Anogenital Distance in Adult Mediterranean Women. *Human Reproduction*, **32**, 2315-2323. https://doi.org/10.1093/humrep/dex274

[13] Wu, Y., Zhong, G., Chen, S., Zheng, C., Liao, D. and Xie, M. (2017) Polycystic Ovary Syndrome Is Associated with Anogenital Distance, a Marker of Prenatal Androgen Exposure. *Human Reproduction*, **32**, 937-943. https://doi.org/10.1093/humrep/dex042

[14] Lin, S., Yang, Y., Chang, C.Y., Lin, C., Hsu, W., Ju, S., *et al.* (2019) Risk of Polycystic Ovary Syndrome in Women Exposed to Fine Air Pollutants and Acidic Gases: A Nationwide Cohort Analysis. *International Journal of Environmental Research and Public Health*, **16**, Article No. 4816. https://doi.org/10.3390/ijerph16234816

[15] Singh, S., Pal, N., Shubham, S., Sarma, D.K., Verma, V., Marotta, F., *et al.* (2023) Polycystic Ovary Syndrome: Etiology, Current Management, and Future Therapeutics. *Journal of Clinical Medicine*, **12**, Article No. 1454. https://doi.org/10.3390/jcm12041454

[16] Witchel, S.F., Oberfield, S.E. and Peña, A.S. (2019) Polycystic Ovary Syndrome: Pathophysiology, Presentation, and Treatment with Emphasis on Adolescent Girls. *Journal of the Endocrine Society*, **3**, 1545-1573. https://doi.org/10.1210/js.2019-00078

[17] Karkera, S., Agard, E. and Sankova, L. (2023) The Clinical Manifestations of Polycystic Ovary Syndrome (PCOS) and the Treatment Options. *European Journal of Biology and Medical Science Research*, **11**, 57-91. https://doi.org/10.37745/ejbmsr.2013/vol11n15791

[18] Gupta, A. and Deshpande, P. (2019) Causes and Prevalence of Factors Causing Infertility in a Public Health Facility. *Journal of Human Reproductive Sciences*, **12**, 287-293. https://doi.org/10.4103/jhrs.jhrs_140_18

[19] Teede, H.J., Misso, M.L., Costello, M.F., Dokras, A., Laven, J., Moran, L., *et al.* (2018) Recommendations from the International Evidence-Based Guideline for the Assessment and Management of Polycystic Ovary Syndrome. *Human Reproduction*, **33**, 1602-1618. https://doi.org/10.1093/humrep/dey256

[20] Christ, J.P. and Cedars, M.I. (2023) Current Guidelines for Diagnosing PCOS. *Diagnostics*, **13**, Article No. 1113. https://doi.org/10.3390/diagnostics13061113

[21] Azziz, R., Carmina, E., Dewailly, D., Diamanti-Kandarakis, E., Escobar-Morreale, H.F., Futterweit, W., *et al.* (2006) Criteria for Defining Polycystic Ovary Syndrome as a Predominantly Hyperandrogenic Syndrome: An Androgen Excess Society Guideline. *The Journal of Clinical Endocrinology & Metabolism*, **91**, 4237-4245. https://doi.org/10.1210/jc.2006-0178

[22] Sidra, S., Tariq, M.H., Farrukh, M.J. and Mohsin, M. (2019) Evaluation of Clinical Manifestations, Health Risks, and Quality of Life among Women with Polycystic Ovary Syndrome. *PLOS ONE*, **14**, e0223329. https://doi.org/10.1371/journal.pone.0223329

[23] Day, F., Karaderi, T., Jones, M.R., Meun, C., He, C., Drong, A., *et al.* (2018) Large-scale Genome-Wide Meta-Analysis of Polycystic Ovary Syndrome Suggests Shared Genetic Architecture for Different Diagnosis Criteria. *PLOS Genetics*, **14**, e1007813. https://doi.org/10.1371/journal.pgen.1007813

[24] Abusailik, M.A., Muhanna, A.M., Almuhisen, A.A., Alhasanat, A.M., Alshamaseen, A.M., Bani Mustafa, S.M., *et al.* (2021) Cutaneous Manifestation of Polycystic Ovary Syndrome. *Dermatology Reports*, **13**, 8799. https://doi.org/10.4081/dr.2021.8799

[25] Dason, E.S., Koshkina, O., Chan, C. and Sobel, M. (2024) Diagnosis and Management of Polycystic Ovarian Syndrome. *Canadian Medical Association Journal*, **196**, E85-E94. https://doi.org/10.1503/cmaj.231251