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A Comprehensive Review on Risk Factors, Clinical Manifestations and Management Strategies of Polycystic Ovarian Syndrome (PCOS)

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ABSTRACT
Polycystic Ovarian Syndrome (PCOS), which is characterised by irregular menstrual periods, harmonal imbalance, and polycystic ovaries, is the most common endocrine disorder affecting women of reproductive age. It is one of the primary reasons of infertility and is associated with metabolic problems. In addition to infertility, women with PCOS have far higher rates of co-morbidities.Patients and the general public still don't know much about PCOS, despite the fact that it has been connected to obesity and other metabolic diseases. Menstrual irregularities, hirsutism, alopecia, obesity, infertility, and acne are all symptoms of this metabolic condition. These symptoms have a detrimental impact on the patients' quality of life, self-esteem, and body image satisfaction. Current research highlights the importance of taking into account these women's psychological issues as well as the necessity of suitable interventions. Obesity, amenorrhoea or oligomenorrhea, infertility, or androgenic characteristics can all be signs of PCOS in women. Additionally, women with PCOS are more likely to develop cardiovascular disease and diabetes and its complications. Numerous long-term issues can be avoided with early PCOS diagnoses and efficient treatment. PCOS can be effectively managed with both pharmaceutical and non-pharmacological methods.However, compliance which is impacted by people's comprehension of the illness is always necessary for therapy to be successful.Therefore, raising awareness of the illness and educating the target audience are essential components of early detection and/or prevention, which eventually lowers the risks related to PCOS. This review article focuses on the many facets of this common yet understated health issue which is silently and steadily trapping more and more women of reproductive age into its web and jeopardizing the overall health and well-being of women.

Keywords: Polycystic ovary syndrome, knowledge, attitude, complications, PCOS, Hormonal imbalance, Menstrual cycles, Metabolic syndrome, Hyperandrogenism (HA), Quality of life (QoL).

I. INTRODUCTION:

Polycystic Ovary Syndrome (PCOS)

One of the most common endocrine conditions affecting people of reproductive age is polycystic ovarian syndrome, or PCOS. PCOS, which is characterised by hormonal abnormalities, irregular menstruation, and the occurrence of ovarian cysts, affects people psychologically in addition to physiologically . PCOS is a complex medical problem that goes beyond gynaecological issues. It is an endocrine condition that shows up as abnormalities in hormone levels, including excess androgen, insulin resistance, and irregular ovulation.(1,2)The Rotterdam criteria, which include hyperandrogenism, irregular menstrual periods, and the appearance of polycystic ovaries on ultrasound, are used to diagnose the syndrome clinically.The impacts of PCOS on mental health and social well-being are just as significant as the physical ones, which have been thoroughly documented.(3)

The concept of quality of life, or QoL, is broad and multifaceted. It is described as a person's view of their own life within the framework of their culture and value systems, as well as their own objectives, standards, and concerns. Health care providers are interested in studies on the quality of life of people with chronic illnesses. They give them the opportunity to learn about the disease's subjective effects on patients' lives and well-being, as well as how it affects care and the methods used for diagnosis and treatment. Conversely, a key element of subjective wellbeing is life satisfaction .(1,3)SwL is created by contrasting one's circumstances with one's standards and objectives

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As a result, each person evaluates and perceives QoL and SwL differently, depending on a variety of conditions. When compared to their age-matched male colleagues, female medical students consistently experience higher levels of total psychological discomfort. About 50% of participants in a cross-sectional research of female medical students reported lower quality of life (QOL) as a result of discomfort brought on by irregular menstruation.In a study of 414 medical students, menstrual irregularities were found to be positively correlated with stress-related melancholy and anxiety . An detailed assessment of the occurrence and effects of menstruation abnormalities among female medical students globally was also provided by a recent systematic review and meta-analysis. Research focused on women with PCOS reveals that they are having difficulty managing the disorder's psychological and physiological impacts while attending medical school . Women's total academic performance has been demonstrated to be adversely affected by the expression of PCOS clinical symptoms .(3,4) According to a recent comprehensive analysis, PCOS-mediated menstrual irregularity is specifically linked to poor academic performance, increased absenteeism, decreased engagement in class activities, and lack of focus . (5) It has been demonstrated that irregular menstruation brought on by PCOS might exacerbate anxiety by causing absenteeism from school and decreased participation at social gatherings. According to theseresearch, up to 20% of PCOS-affected medical and dentistry students suffer from excruciating discomfort, which lowers their quality of life and subsequently causes depressive symptoms. It has been demonstrated that targeted stress management programs significantly enhance PCOS patients' quality of life by lowering symptoms of anxiety and sadness. Unsettlingly, several studies have demonstrated that women with PCOS who exhibit related difficulties are typically encouraged to use other medicines and other medications like metformin, which might result in a lifelong dependence on these pharmacological agents (5,6).

II. REVIEW

PCOS is a complex condition diagnosed by the presence of at least two of the following three criteria: hyperandrogenism, ovulatory dysfunction, and polycystic ovaries . The condition is the most common endocrinopathy among reproductive-aged women in the United States, affecting approximately 7% of female patients . The exact etiology of PCOS is thought to emerge from a complex interaction of genetic and environmental traits, with evidence indicating a strong correlation between familial factors and the presence of PCOS. PCOS affects women's mental health and quality of life, with anxiety and depression being prevalent issues among patients . Studies have shown that women with PCOS tend to experience mildly elevated anxiety and depression .A woman's identity, mental health, and quality of life are all impacted by the stigmatising disorder.(6,7) Among women with PCOS, the prevalence of depression and anxiety disorders varies from 11% to 25% and 28% to 39%, respectively . Although it was once thought to be an adult female condition, it is now thought to be a lifelong syndrome. Different phenotypes of the condition have been identified and stratified based on the various combinations of symptoms and signs due to the variety of its presentation, which has made diagnosis extremely challenging. PCOS has a wide range of clinical manifestations.(4,8) However, irregular menstrual periods, hirsutism (abnormal development of face and skin hair), acne, infertility, and often obesity are the typically noticed signs when fully expressed. Since there isn't a single diagnostic criterion for this syndrome , the choice of diagnostic criteria determines the prevalence of PCOS. To make the right diagnosis, a comprehensive physical examination, medical history, and laboratory testing should be carried out (Witchel et al., 2015). According to each recommendation, every pathological disease that could account for the hyperandrogenism or irregular menstruation must be ruled out.(6,9,10)

III. ROLE OF HARMONES IN PCOS

Understanding the pathophysiology of PCOS depends critically on the function of hormones. Key factors in the development of PCOS include insulin resistance, altered luteinizing hormone (LH) action, and a possible tendency to hyperandrogenism . According to one idea, hyperandrogenism is exacerbated by underlying insulin resistance. This leads to increased androgen levels by suppressing the production of sex hormone-binding globulin and increasing the synthesis of androgens in the ovaries and adrenal glands. (1,11)These hormonal abnormalities are closely associated with the diagnostic criteria for PCOS, which include hyperandrogenism, ovulatory dysfunction, and the presence of polycystic ovaries.The illness has a substantial negative

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influence on women's mental health and general quality of life in addition to its physical symptoms. PCOS is rather common, which emphasises how crucial it is to comprehend its hormonal foundations. (12)The interaction of these hormones has long-term health consequences in addition to contributing to the distinctive symptoms that characterise PCOS. Understanding the crucial role of hormones, particularly insulin resistance and hyperandrogenism, lays the groundwork for creating focused therapies and therapeutic approaches meant to address the hormonal imbalances that underpin the complicated terrain of PCOS.(11)

IV. PATHOGENESIS OF PCOS

PCOS is a complicated and multifaceted pathogenesis that includes transgenerational, environmental, and genetic factors. These sources promote ovarian and adrenal hyperandrogenism by driving the foundations of imbalanced hypothalamus-pituitary-ovarian axis signalling. Insulin resistance, hyperinsulinemia, and hormonal imbalance combine to cause PCOS. Excess insulin brought on by insulin resistance increases the amount of free androgens in the blood by stimulating the production of androgens by ovarian theca cells and lowering SHBG.Increased GnRH pulse frequency also promotes androgen production and hinders follicular maturation by raising LH and decreasing FSH.(12,13) Follicular stoppage, anovulation, and the development of numerous tiny cystic follicles result from the growing follicles failing to mature. Excess androgens cause clinical features like hirsutism, acne, and menstrual irregularities. Genetic predisposition**,** obesity, and chronic low-grade inflammationworsen insulin resistance and perpetuate the cycle.(1,8)

4.1 Genetic and Familial Predisposition - Given that PCOS frequently runs in families, there may be a significant hereditary component. Numerous genes linked to inflammation, testosterone synthesis, and insulin action have been identified. PCOS is more common in women who have a family history of metabolic syndrome, type-2 diabetes, or PCOS. Environmental factors including nutrition, lifestyle, and weight affect whether symptoms appear, while these genetic factors provide a background predisposition.(10,13)

4.2 Insulin Resistance and Hyperinsulinemia- Insulin resistance is one of the most commonly acknowledged pathways in the pathophysiology of PCOS. Tissues including muscle and fat do not react appropriately to insulin in many PCOS-affected individuals. The pancreas generates more insulin as a compensatory mechanism (hyperinsulinemia).(11,14)Increased LH action on the ovarian theca cells, stimulation of the ovaries to make more androgens, and a decrease in the liver's production of sex hormone-binding globulin (SHBG), which raises the amount of free testosterone in the blood, are all effects of elevated insulin. The development and maintenance of PCOS symptoms are largely dependent on this metabolic-hormonal interplay.(11)

4.3 Ovarian Androgen Excess-Excess androgen synthesis, especially by the ovaries' theca cells, is the characteristic of PCOS. Elevated insulin levels increase androgen release by making the ovarian theca cells more sensitive to LH. By interfering with normal follicle development, these androgens stop the egg from maturing and being released. The ovaries' distinctive "polycystic" appearance results from the accumulation of numerous tiny immature follicles rather than the emergence of a dominant follicle.(14)

4.4 Altered Gonadotropin Secretion - Dysregulation of the hypothalamic-pituitary-ovarian (HPO) axis is another significant factor. GnRH pulses, which preferentially induce the release of LH over FSH, are frequently more frequent in women with PCOS. LH levels thus increase while FSH stays comparatively low or normal. Anovulation is further exacerbated by this hormonal imbalance, which also hinders the development of ovarian follicles and increases androgen synthesis by theca cells. One of the traditional characteristics of PCOS pathophysiology is the consistently elevated LH:FSH ratio.(2,4)

4.5 Follicular Arrest and Anovulation-Follicular arrest is a disorder where follicles begin to grow but do not mature due to the combined effects of excessive androgens, low FSH, and insulin resistance. Ovulation does not take place in the absence of appropriate maturity. Lack of ovulation causes low progesterone and ongoing oestrogen exposure in the endometrium, which raises the risk of endometrial hyperplasia over time and causes irregular or heavy monthly flow.(1)

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V. SIGNS AND SYMPTOMS

5.1 Environmental and LifestyleFactors - The underlying hormonal imbalance may be made worse by things like a diet heavy in refined carbohydrates, a sedentary lifestyle, stress, and exposure to substances that alter hormones. Gaining weight raises insulin resistance, which increases the synthesis of androgen. This leads to a vicious cycle where problems related to reproduction and metabolism reinforce one another.(10,13)

5.2 Irregular periods- It is a hallmark symptom of PCOS. The patient may experience rare or absent menstruation. The interval between the consecutive menstruations can be reduced or prolonged. Furthermore, in some cases, menstruating days can be very long. Heavy or light bleeding may occur and sometimes spotting between periods can also be seen.(15,16)

5.3 Infertility- PCOS is the most common cause of infertility. One in five infertile women have PCOD. Increased levels of androgen may affect the ovary condition and ovulation. If a person is trying and failing to conceive for over a year, it can be a sign of PCOS.

5.4 Menstrual Irregularities- Menstrual irregularities or absence are among the most prevalent symptoms of PCOS. This occurs as a result of hormonal imbalances that cause ovulation to occur irregularly or occasionally not at all.Cycles longer than 35 days, fewer than eight periods annually, or strong, protracted menstrual bleeding are all possible for women. It might be challenging to monitor fertility and comprehend their natural cycle because some people may even spend months without getting their period.(9,14)Excess Androgen Levels (Male Hormone Symptoms)- An rise in androgen levels brought on by PCOS frequently results in physical changes. These include hirsutism, a condition characterised by excessive hair growth on the face, chest, stomach, or back. Additionally, a lot of women have chronic acne that doesn't go away with standard therapies. Androgenic alopecia, a condition where hair on the scalp thins in a pattern resembling male baldness, is another prevalent symptom. These alterations may be among the first symptoms observed and have an impact on self-esteem.(3,4)

5.5 Polycystic Ovaries- Some women with PCOS have enlarged ovaries containing multiple small follicles that look like cysts on ultrasound. These follicles are actually immature eggs that do not develop properly due to disrupted hormonal signals.While not all women with PCOS have visible cysts, the presence of these "string of pearl" follicles can support the diagnosis when combined with other symptoms. Polycystic ovaries may cause pelvic discomfort for some, though many women experience no pain at all.(3)

5.6 Weight Gain and Metabolic Changes- One common symptom of PCOS is weight gain, particularly around the belly, which can exacerbate other symptoms. Insulin resistance, or the body's inability to use insulin efficiently, is common in women with PCOS. Increased appetite, trouble reducing weight, and elevated blood sugar levels can result from this.Acanthosis nigricans, a black, velvety patch of skin typically found on the neck, groin, or underarms, can develop over time as a result of insulin resistance. Additionally, metabolic problems raise the risk of high blood pressure, high cholesterol, and type 2 diabetes.(9,15)

5.7 Fertility and Ovulation Problems -Because PCOS disrupts regular ovulation, it is one of the main reasons of infertility. The release of an egg becomes erratic or may cease completely in the absence of regular ovulation.Although many women with PCOS can become pregnant with the right care, this can make conception difficult.These fertility issues are frequently accompanied by symptoms including irregular periods, trouble estimating ovulation, and hormonal abnormalities.(17,18)

5.8 Emotional and Psychological Symptoms- Mental health can also be impacted by PCOS. Anxiety, despair, or mood swings can be caused by hormonal imbalances as well as physical signs like weight fluctuations or excessive hair growth.Some women are frustrated by their inability to control their weight or fertility, or they feel overpowered by their symptoms. Women with PCOS are also more likely to experience sleep issues, such as sleep apnoea, especially if they are overweight.(10,13)

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5.9 Weight gain- Another sign of PCOS is if a person has a tendency to gain weight in spite of eating less and exercising frequently. When a patient has PCOS , they primarily acquire weight around the waist.(13)

5.10 Menstrual Irregularities- Up to 75–85% of people with PCOS have irregular menstruation, which is one of the condition's defining characteristics. Due to disruptions in ovarian function and menstrual cycle management, women with PCOS may exhibit amenorrhoea (absence of menstrual periods) or oligomenorrhea (infrequent menstrual periods). Menstrual cycles lasting more than 35 days or less than eight periods annually are classified as oligomenorrhea, and the absence of periods for three consecutive months or more is classified as amenorrhoea.Anovulatory cycles, in which follicular growth and ovulation are disturbed by hormonal imbalances and ovarian dysfunction, are the cause of irregular menstruation in PCOS.(1,4) Insufficient progesterone production in the absence of ovulation results in uneven endometrial lining shedding and either absent or delayed withdrawal bleeding.Infertility, endometrial hyperplasia, and an elevated risk of endometrial cancer are just a few of the serious reproductive health consequences of menstrual irregularities in PCOS. In order to restore ovulatory function and encourage monthly regularity, the evaluation and treatment of menstrual abnormalities are crucial elements of PCOS therapy.(10,12)

VI. MENTAL HEALTH IMPACTS OF PCOS-

People with PCOS frequently struggle with increased risks of anxiety and despair, making the relationship between PCOS and mental health complicated. PCOS-related hormonal abnormalities can exacerbate mood problems and increase the likelihood of anxiety and depression symptoms. In addition to the medical aspects, people with PCOS are more likely to experience anxiety and depression due to the psychological toll of managing a chronic illness, social expectations, and possible fertility issues. Fostering a comprehensive approach to PCOS care requires acknowledging and treating these mental health concerns . Depression, anxiety, bipolar illness, and obsessive-compulsive disorder are all more likely to be diagnosed in those with PCOS .Research has indicated that women with PCOS are more likely to be clinically diagnosed with depression and to have worse anxiety and depressive symptoms .(3)Among women with PCOS, the prevalence of depression and anxiety disorders varies from 11% to 25% and 28% to 39%, respectively . Poor lifestyle choices and ignorance are thought to be the main causes of this illness. Nurses are uniquely positioned to raise awareness of this illness. Making educated decisions and managing stress and weight loss are important aspects of managing this illness.(3,15)

VII. DIAGNOSTIC CRITERIA OF PCOS

The diagnosis of Polycystic Ovarian Syndrome (PCOS), a complicated endocrine condition with a wide range of clinical symptoms, is difficult. In order to standardise PCOS diagnosis and direct clinical management, a number of diagnostic criteria have been put out over time. (19)The Rotterdam criteria, difficulties and disputes in diagnosis, and the function of laboratory testing in verifying the diagnosis are all covered in this section along with the diagnostic criteria for PCOS. 5% to 20% of people in the 46XX reproductive age range have PCOS. The majority of consensus definitions define PCOS as a disorder characterised by either clinical or biochemical hyperandrogenism and persistent anovulation, excluding other conditions with comparable characteristics (such as Cushing's syndrome, 21-hydroxylase deficiency, androgen-secreting tumours, etc.).(20,21) There are three sets of PCOS diagnostic criteria. They were put forth by the Androgen Excess and PCOS Society (AES) in 2009, the Rotterdam Consensus meeting in 2003, and the National Institutes of Health (NIH) in 1990. Menstrual irregularities (oligo- or anovulation) and either clinical or biochemical hyperandrogenism of ovarian origin are required under NIH criteria . Rotterdam Standards: The most widely recognised diagnostic criteria for PCOS are the Rotterdam criteria, which were developed in 2003 during a consensus workshop supported by the American Society for Reproductive Medicine (ASRM) and the European Society for Human Reproduction and Embryology (ESHRE) .(20) The Rotterdam criteria state that at least two of the three requirements must be met in order to diagnose PCOS:1. Hyperandrogenism: Clinical and/or biochemical evidence of hyperandrogenism, including hirsutism, acne, and male-pattern baldness, or elevated levels of serum androgens (e.g., testosterone, free testosterone, or DHEAS). 2. Oligo-Anovulation: Menstrual irregularities, such as oligomenorrhea (menstrual

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cycles longer than 35 days) or amenorrhea (absence of menstrual periods for three or more consecutive months), indicating anovulation or oligo-ovulation. 3. Polycystic Ovarian Morphology: The presence of polycystic ovarian morphology on ultrasound imaging, characterized by the presence of 12 or more small follicles (2-9 mm in diameter) arranged peripherally around the ovarian stroma or increased ovarian volume (>10 mL).(22,23)

VIII. ROLE OF LABORATORY TESTS

In order to establish the diagnosis of PCOS and assess related metabolic and hormonal problems, laboratory testing is essential. Important laboratory tests for PCOS diagnosis include: 1. Hormonal Profiling: Measuring serum levels of gonadotropins (such as LH, FSH), sex hormone-binding globulin (SHBG), and androgens (such as testosterone, free testosterone, and DHEAS) might reveal important details about hormonal abnormalities linked to PCOS. Hyperandrogenism is indicated by high levels of androgens, especially testosterone and DHEAS, and dysregulated gonadotropin production is suggested by an elevated LH-to-FSH ratio (>2:1). 2. Imaging Studies: To evaluate ovarian morphology and detect the existence of polycystic ovaries, transvaginal ultrasound imaging is frequently utilised. (24,25)Increased ovarian volume (>10 mL) or 12 or more tiny follicles (2–9 mm in diameter) positioned peripherally surrounding the ovarian stroma are the diagnostic criteria for polycystic ovarian morphology on ultrasonography imaging. Additionally, imaging tests like magnetic resonance imaging (MRI) and pelvic ultrasound can be utilised to rule out ovarian or adrenal tumours that mimic PCOS and assess for other pelvic disease.3. Biomarkers Anti-Müllerian hormone (AMH) and adipokines (such as leptin and adiponectin) are examples of emerging biomarkers that have demonstrated potential in supporting PCOS diagnosis and characterisation. Women with PCOS have higher levels of AMH, a measure of ovarian reserve, which may be correlated with the degree of ovarian dysfunction and polycystic ovarian morphology. (19,20,26)Adipose tissue secretes adipokines, which are involved in insulin sensitivity and metabolic control. Women with PCOS may have dysregulated adipokines, which can shed light on the metabolic phenotype of the condition. The Rotterdam criteria are the most often used diagnostic framework for Polycystic Ovarian Syndrome (PCOS), which is diagnosed using a mix of clinical, biochemical, and imaging criteria. PCOS diagnosis issues and disputes include overdiagnosis and phenotypic variability.(26,27)

IX. MANAGEMENT AND TREATMENT

Depending on the patient's unique presentations and concerns, a variety of therapy techniques should be used. Many features of PCOS are improved by changing one's lifestyle. Reducing body weight by 5% to 10% can improve ovulation, lower circulating androgens, lower insulin resistance, and boost pregnancy rates. Exercise improves menstrual regularity, increases insulin sensitivity, and reduces hirsutism, even if it does not result in this level of weight loss. Insulin sensitisers like metformin and thiazolidinediones (TZDs) can also lower insulin resistance. Effective PCOS care offers a potential window of opportunity to reduce the risk of related problems. (19,26)It is commonly acknowledged that the treatment of PCOS depends on the symptoms, which may include menstruation problems, androgen-related symptoms, or infertility linked to ovulatory failure. Customising therapy choices to each patient's needs can be a challenging clinical task due to the complexity of PCOS.The long-term hazards of PCOS must be weighed against the patients' immediate demands, such as the need to reduce the cosmetic difficulties brought on by PCOS and the desire to maintain fertility. The main treatment for metabolic problems in overweight and obese women with PCOS is lifestyle management (diet and exercise), according to the Androgen Excess and Polycystic Ovary Syndrome Society.(19)

9.1 Lifestyle modification-Because of the ovarian cyst, PCOD patients have unbalanced amounts of progesterone and oestrogen. This could lead to problems with the menstrual cycle, heart health, and fertility. Changes in lifestyle can help control PCOD, which is a lifestyle-oriented disorder.The key lifestyle adjustments that need to be made include prioritising blood sugar stability to reduce hyperinsulinemia, managing stress on a daily basis, eating a low-carb diet, engaging in regular physical activity, and routinely checking vitamin D levels.[9] PCOD can also be improved by abstaining from alcohol, junk food, and drinks.(28)

9.2 Improving metabolic health-Regaining regular menstruation and controlling conditions like acne, infertility, and excessive hair growth. Because every woman with PCOS

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presents differently, the aim of treatment can change based on whether the patient wishes to regulate symptoms, decrease weight, or become pregnant. Lifestyle adjustment, which entails eating a balanced diet, exercising frequently, and losing weight if overweight, is the primary line of treatment.Reducing androgen levels, regulating menstrual periods, and improving insulin sensitivity can all be greatly enhanced by even a small weight loss of 5–10%.While frequent exercise improves the body's reaction to insulin and promotes general metabolic health, a balanced diet with less refined carbohydrates, more fibre, and lean proteins is advised.(29,30)Combined oral contraceptive pills are frequently used to regulate hormones and control the menstrual cycle.These medications help treat hirsutism and acne, lower androgen production, raise SHBG levels, and control monthly cycles. Progesterone therapy can be used sporadically to protect the endometrium and cause frequent withdrawal bleeding in women who are unable to use estrogen-containing medications. Metformin is widely used to treat insulin resistance, a major cause of PCOS. It may lower the long-term risk of type-2 diabetes, assist regulate weight, enhance insulin sensitivity, and aid in ovulation restoration. Ovulation-inducing drugs like letrozole (first-line) or clomiphene citrate are provided to women with fertility issues in order to induce ovulation; if medicine is not successful, assisted reproductive procedures may be taken into consideration.(27)

9.3 Management of cosmetic symptoms- Topical therapies, dermatological procedures like laser hair removal, and anti-androgen drugs like spironolactone are used to treat cosmetic symptoms such acne and excessive hair growth. Because anti-androgens can impact foetal development, these treatments must be used in conjunction with effective contraception.Monitoring for PCOS-related issues such metabolic syndrome, hypertension, dyslipidaemia, and endometrial hyperplasia is another aspect of long-term treatment. (31,32)Regular screening for menstrual cycle patterns, lipid profiles, and blood glucose levels is recommended for women. Because PCOS can have a substantial impact on mental health and result in anxiety, despair, or low self-esteem, psychological support is equally crucial.(33)

9.4 Surgical Interventions-Sometimes PCOS-related symptoms might be relieved by surgical procedures. Patients who are extremely obese should be offered bariatric surgery since it is a successful treatment for obesity and PCOS symptoms when all other choices have been exhausted. However, pregnancy should not be pursued during the 12 months after surgery due to the dangers, which include nutritional and surgical issues. In order to rebalance and enhance ovarian function in PCOS, laparoscopic ovarian drilling is a minimally invasive surgery that involves destroying ovarian tissue with a laser beam or a surgical needle. (19,22,28)Although the operation is uncommon, it is still an option in cases with ovaries resistant to clomiphene citrate and when letrozole is not an option because of off-label use. However, compared to medical ovulation induction alone, laparoscopic ovarian drilling may actually lower the live birth rate in women with anovulatory PCOS and clomiphene citrate resistance, despite lowering the number of multiple pregnancies and the risk for ovarian hyperstimulation syndrome. It is important to remember that women undergoing laparoscopic ovarian drilling are also at risk for surgical complications, including adhesions, infection, and anaesthesia.(34–36)

X. PHARMACOLOGICAL

Menstrual irregularity, hyperandrogenism, insulin resistance, infertility, and metabolic dysfunction are all targets of various medication classes used in the pharmacological management of PCOS. Because they control menstrual cycles, suppress ovarian androgen production, and raise SHBG to lower free testosterone levels, combined oral contraceptive pills (COCPs), which contain ethinyl oestradiol with progestins like drospirenone or levonorgestrel, are the first-line treatment for women who are not seeking pregnancy. For those who are unable to use oestrogen, cyclic progesterone therapy, such as medroxyprogesterone acetate, is used to induce withdrawal bleeding and protect the endometrium. Metformin is the most often recommended medication to treat insulin resistance, a major cause of PCOS. It improves insulin sensitivity and aids in the restoration of ovulation; thiazolidinediones, such as pioglitazone, are less frequently used because of side effects.(26,28,30,38,39) Ovulation-inducing medications, such as clomiphene citrate

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and letrozole (first-line), are used to promote follicular development in situations of infertility. Injectable gonadotropins or hCG trigger injections may be necessary in cases of resistance. Anti-androgens including spironolactone, finasteride, and flutamide—taken in conjunction with effective contraception—as well as topical eflornithine for facial hair are used to treat hyperandrogenic symptoms like hirsutism and acne.Orlistat and GLP-1 agonists like liraglutide or semaglutide for weight loss, as well as dermatological medications including topical retinoids, benzoyl peroxide, and isotretinoin for acne control, are additional supportive treatments. In order to accomplish comprehensive care of PCOS, these drugs are generally utilised according to individual symptoms and reproductive objectives.(14,19,40)The goals of Pharmacological Treatment for PCOS are to improve metabolic dysfunction, restore ovulation, correct hormonal imbalance, and manage symptoms such irregular periods, hirsutism, and acne. Depending on whether a woman's main concerns are metabolic health, menstrual management, fertility, or cosmetic issues, drug therapy is customised.Combined oral contraceptive pills (COCPs) are the first-line pharmacological treatment for many women, particularly those who are not trying to conceive. These pills contain estrogen and progestin, which help regulate menstrual cycles, lower ovarian androgen production, and increase sex hormone–binding globulin (SHBG), thereby reducing free testosterone levels. (17,18,22)This improves symptoms like acne and hirsutism. For women who cannot take estrogen, **cyclical progesterone therapy** may be used to induce regular withdrawal bleeding and protect the endometrium from hyperplasia caused by unopposed estrogen.Because it can enhance insulin sensitivity, lower circulating insulin levels, and reduce androgen production, metformin is frequently used to treat the underlying metabolic disorder. Metformin is helpful for those with obesity, insulin resistance, or impaired glucose tolerance. It also helps some women regain ovulation.(18,19,22)Metformin may also help regulate weight and lower the long-term risk of type-2 diabetes. There are other insulin-sensitizing medications, like thiazolidinediones, although their usage is less prevalent because of potential negative effects.A Letrozole, an aromatase inhibitor that raises FSH levels and promotes follicular growth, is the first-line ovulation induction medication for infertile women. Clomiphene citrate may be used as a substitute if letrozole is ineffective. Gonadotropin injections or assisted reproductive methods like IVF may be taken into consideration in cases of resistance. Metformin therapy and weight loss may potentially improve response to fertility drugs.(26,30,39)

10.1 Anti-androgen therapy may be necessary to manage androgen-related symptoms. By blocking androgen receptors or preventing the generation of androgens, medications like finasteride, flutamide, and spironolactone help lessen acne and hirsutism.Because these medications have the potential to feminise a male foetus, they must be used in conjunction with good contraception. For the purpose of reducing facial hair, dermatologic therapies like topical eflornithine may also be recommended.In certain situations, weight loss may be supported by drugs that target metabolic and weight problems, such as orlistat or GLP-1 receptor agonists (like liraglutide), which indirectly alleviates PCOS symptoms. (25,29)Finally, since PCOS is a chronic disorder requiring long-term management, medication should be supplemented with continuous monitoring of metabolic markers, menstrual cycles, and psychological health.(27,41)

10.2 Integrating Psychosocial Support into PCOS care Multidisciplinary Approach in Healthcare-In order to successfully incorporate psychosocial support into PCOS care, healthcare settings must adopt a multidisciplinary approach. Healthcare experts such as gynaecologists, endocrinologists, mental health practitioners, and nutritionists must work together on this.A multidisciplinary approach guarantees that people with PCOS receive comprehensive care that addresses the physical and emotional aspects of their health by promoting communication and teamwork. This collaborative approach stresses a thorough treatment strategy while acknowledging the interconnectedness of PCOS.(41,42)

10.3 Counseling and Mental Health Services- Addressing the psychological effects of PCOS requires regular inclusion of counselling and mental health services. Counsellors and psychologists are examples of mental health specialists who can help with PCOS-related stress, anxiety, and depression.Proactive detection of psychosocial issues and prompt interventions are made possible by

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incorporating routine mental health check-ins into the care protocol. Healthcare professionals support a more patient-centered and all-encompassing approach to PCOS care by making mental health services easily available .(31,32,42)

10.4Patient-Centered Care Models-Individuals' distinct needs, preferences, and experiences are given priority in patient-centered care models. Setting reasonable treatment goals, actively integrating patients in decision-making, and taking into account their psychosocial well-being are all necessary components of patient-centered PCOS care. By encouraging a cooperative relationship between patients and healthcare professionals, this strategy enables people to take an active role in their care. Patient-centered treatment approaches acknowledge the significance of treating PCOS's emotional and social components as well as its medical symptoms, which have a substantial impact on general wellness .(42–45)

XI. CONCLUSION

Numerous physical and psychological effects are associated with polycystic ovarian syndrome, a multisymptomatic illness.PCOS sufferers' psychological well-being is significantly impacted by a number of issues. Coping with the disease, experiencing infertility-related anxieties, losing femininity, having a less appealing body, and worrying about bodily disruption are some of these issues . According to this study's review of the literature, physicians should screen and treat PCOS patients with care and awareness because they are at a higher risk of developing common mood and anxiety disorders as well as making suicide attempts.Therefore, a therapeutic strategy is necessary for PCOS patients. Every woman should have access to information about the range of health problems that affect women, with PCOS being a major one. As they say, "A stitch in time saves nine" and "Prevention is better than cure." As a result, current efforts to raise awareness among Indian women can undoubtedly direct them to seek medical attention when necessary. Additionally, it can encourage people to have a healthy lifestyle in order to prevent this complicated illness or, in the event that they are affected, to frequently lessen the symptoms and promote effective treatment.PCOS is a silent condition that poses a major risk to women's physical and mental health. The clinical characteristics of PCOS are better managed when the condition is detected early. However, different published scales are used to assess PCOS symptoms, which contributes to the variation in prevalence statistics across the globe. Patients with a strong family history should also be assessed for genetic and environmental variables, given the varied aetiology of PCOS pathogenesis, which includes insulin resistance, adipogenicity, and androgenicity. It may be possible to find candidate genes for targeted therapy through additional research on a variety of populations. In order to prevent long-term issues like endometrial cancer, metabolic and system-specific consequences should also be taken into account and monitored medically.Early PCOS detection and care would be aided by raising knowledge of PCOS-associated comorbidities among young groups, such as medical students. The psychological and social circumstances of the patient should be taken into account before any ideal intervention. To attain long-term emotional well-being, patients should also undergo counselling from a psychiatrist or other healthcare expert as part of their therapy and care.In conclusion, clinicians should be aware of these psychiatric comorbidities because anxiety and depression are common in females with PCOS and have major consequences. Additionally, they must guarantee that patients receive sufficient medication and psychotherapy. Additionally, nurses and other medical professionals can assist PCOS patients develop better coping mechanisms by offering psychosocial education and support.

Future Directions - A multidisciplinary and customised strategy is necessary for the effective therapy of PCOS. The key is changing one's lifestyle, which includes eating a balanced diet high in fibre and low in refined carbohydrates, exercising frequently, and controlling weight because even a small amount of weight loss can enhance ovulation, insulin sensitivity, and hormonal balance. Menstrual cycles, metabolic indicators (blood glucose, lipid profile, blood pressure), and reproductive health—including assessment of endometrial thickness where necessary—should all be routinely monitored in women with PCOS.(43,46,47)Pharmacological treatment, such as metformin for insulin resistance, ovulation-inducing drugs for fertility, and combined oral contraceptives for menstrual management and hyperandrogenism, should be customised to symptoms and objectives. Topical medications or anti-androgens can be used to treat cosmetic issues like acne and hirsutism.Because PCOS is frequently linked to anxiety, depression,

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and a lower quality of life, psychological support is advised. In order to promote adherence to lifestyle and treatment programs, it is also crucial to educate patients about long-term hazards, such as type-2 diabetes, cardiovascular disease, and endometrial hyperplasia. To improve girls' understanding of polycystic ovarian syndrome symptoms, a comprehensive teaching program should be put in place. Educating teenage girls about polycystic ovarian syndrome risk factors and preventative strategies. Encourage teenage females to maintain healthy habits, a balanced diet, and occasional exercise to prevent weight gain.

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